STS-114/LF1

FD 08 Execute Package

MSG	Page(s)	Title
079D	1 - 17	FD08 Flight Plan Revision **(pdf)**
080A	18 - 19	FD08 Mission Summary **(pdf)**
081	20 - 24	FD08 Transfer Message **(pdf)**
082	25 - 26	Revised LiOH Cue Card **(pdf)**
083	27 - 31	EVA 3 Hacksaw Assembly **(pdf)**
084A	31	FD08 PAO VIP Event Summary **(pdf)**
085A	31	FD08 Crew Conference Event Summary **(pdf)**
086	32 - 35	IVA Plug Demo Procedure **(pdf)**
087	36 - 37	FD08 Water Activity Summary **(pdf)**
088	38 - 39	EVA 3 Hacksaw Practice Setup **(pdf)**
089	40 - 111	FD07 MMT Summary **(pdf)**
090	112 - 116	ESP-2 Backoff to MBS PDGF 1 Pregrapple **(pdf)**
091	117 - 120	MBS PDGF 1 Pregrapple to ESP-2 Backoff **(pdf)**
092	121 - 138	EVA - Gap Filler Support **(pdf)**
094	139	Replacement Page for MSG 075 (11-0688) Page 2 **(pdf)**
095	140	SRMS and SSRMS Manuever Plan for EVA 3 **(pdf)**

Approved by FAO: *L. DeLapp*
OPS Plan: *J. Aldape*

Last Updated: Aug 2 2005 3:32AM GMT
JEDI *(**J**oint **E**xecute package **D**evelopment and **I**ntegration), v2.04.0003*

MSG 079D - FD08 FLIGHT PLAN REVISION

MSG INDEX

MSG NO.	TITLE
79	FD08 Flight Plan Revision
80	FD08 Mission Summary (11-0692)
81	FD08 Transfer Message (11-0693)
82	Revised LiOH Cue Card
83	EVA 3 Hacksaw Assembly
84	FD08 PAO VIP Event Summary (11-0695)
85	FD08 Crew Conference Event Summary (11-0696)
86	IVA Plug Demo Procedure
87	FD08 Water Activity Summary
88	EVA 3 Hacksaw Practice Setup
89	FD07 MMT Summary (11-0697)
90	ESP-2 Backoff to MBS PDGF 1 Pregrapple (11-0698)
91	MBS PDGF 1 Pregrapple to ESP-2 Backoff (11-0699)
92	EVA - Gap Filler Support (11-0700)
93	Revised EVA 3 Procedures (To Be Uplinked Later in FD08)
94	Replacement Page for MSG 075 (11-0688) Page 2 (11-0701)
95	SRMS and SSRMS Maneuver Plan for EVA 3(11-702)

1. Post Sleep Cryo Config:

   R1 CRYO O2, H2 MANF VLV TK2 - OP (tb - OP)

   A15 CRYO TK5 HTR O2 A - AUTO
   H2 A, B (two) - AUTO

   A11 CRYO TK4 HTR O2 A - OFF
   H2 A, B (two) - OFF

2. The photo/TV community is recommending that you update the firmware in the EVA cameras prior to EVA 3. You previously did this on FD4 per message 56 and can use that procedure to perform this update.

   The concern is that the cameras may have taken a hit during EVA 2 and there is no way of knowing whether or not the proper firmware is loaded in both slots of each camera. If it is not, then a single additional problem will render the camera unusable.

3. On EV2's EMU TV camera, please inspect the center camera lens for debris or damage. If necessary, you can use the yellow 3M lens cleaning wipes from the 35mm camera bag (panel A16) for general cleaning. If the material appears gooey, please contact MCC prior to attempting cleaning to discuss alternative cleaning options.

4. Steve - We heard your comments about the stickiness of your MWS End Effector. If you could provide us with more details that would be great.

   If you would like to use a different MWS Gimbal Assembly (T-Bar) w/ a different End Effector for EVA 3, there are two spares both located in the ISS Equipment Lock. The first is (MWS Gimbal Assembly) is located in A/L101-CTB 1013 (MUT & MWS parts Bag) and should be P/N SEG33110493 & S/N 1005. The second is on the MWS Baseplate on the PERS strap and should be S/N 1004. If you decide to swap T-Bars, please let us know the S/N of the one you are currently using that has been causing problems and the S/N of the one you swap to.

5. We've uplinked a new LiOH cue card (MSG 82). We'd like you to remove and replace the old cue card with the new one. The cue card was changed as a result of 6 additional LiOH cans going to ISS. The transfer change is reflected in block D in the transfer block on the back of the cue card. LiOH Exchange D is scheduled for today at 6/15:25 MET.

   The PPCO2 levels have been very low throughout the mission so the morning changeouts on FD9, 10, & 11 will be skipped. This results in a savings of 6 cans.

6. As requested pre-flight, we've uplinked the latest IVA Plug Demo procedure (MSG 086). This will still happen as previously scheduled on FD9 prior to EVA 3.

7. Uplink the following pen and ink changes to the EVA Checklist:

   STS-114 LOGISTICS CUE CARD (EVA, AIRLOCK CONFIG), FS CC 2-14
   Replace battery 1029 in the Post EVA 2 Battery Recharge diagram (previously removed per MSG 021A, Item 9), with battery 1020

   EMU CONSUMABLES TRACKING CUE CARD (EVA, AIRLOCK CONFIG), FS CC 2-15

   Under EV-1 - Ng, EVA 2 row, Helmet Light Column
   WAS (per Msg 021A, Item 10):
   1020/1035
   (both old)
   recharge 1035

   IS:
   1020/1035
   (both old)
   recharge

8. At your convenience, visually inspect the starboard External Airlock Outer Hatch Equalization Valve by removing the cap. Report any observations of debris on the screen or in the valve and download any digital images if required.

   During EVA #3, please use the starboard equalization valve for the Airlock depress during Cleanup Ingress to attempt to replicate the signature. If starboard valve fails to depress the Airlock, use the port equalization valve as was done for EVA #2.

9. There are no exercise constraints for FD08.

10. REPLACE PAGES 2-16A THROUGH 2-17A AND 3-80 THROUGH 3-89.

08/01/05 22:03:19 **REPLANNED**

GMT 08/02/05 (214): 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14

MET Day 006: 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 007/00

FD08

Crew	Activities (in time order)
STS-114 CDR COLLINS	SLEEP / POST SLEEP / I'CNCT / ATT HO* / MNVR -XLV / WASTE INIT / O2 INIT / WASTE TERM / CWC OVERBOARD DUMP / MNVR -XLV / ATT HO* / I'CNCT / PWR FILL / CREW PHOTO / CREW CONF / MEAL / PWR FILL / CWC INIT 12 / EXERCISE / CWC TERM / XFER CWC / O2 TERM / PAO EVENT
STS-114 PLT KELLY	SLEEP / SALIVA / POST SLEEP / EXERCISE / EVA PROC REVW / EVA3 DOUG RVW / TRANSFER / CREW PHOTO / CREW CONF / MEAL / SSRMS ESP2 GRPL / ESP2 UNBRTH / TRANSFER / PAO EVENT
STS-114 MS1 NOGUCHI	SLEEP / POST SLEEP - GIRA / EXERCISE / ASPRN / MDDK PREP / EVA PROC REVW / HACK SAW ASMBLY / HACK PRAC / EVA CAMR / CREW PHOTO / CREW CONF / MEAL / EVA TOOL CONFG / TRANSFER / PAO EVENT
STS-114 MS2 ROBINSON	SLEEP / POST SLEEP / EXERCISE / POST SLEEP / ASPRN / MDDK PREP / EVA PROC REVW / HACK SAW ASMBLY / HACK PRAC / DCS FMT / CREW PHOTO / CREW CONF / MEAL / EVA TOOL CONFG / TRANSFER / PAO EVENT
STS-114 MS3 THOMAS	SLEEP / POST SLEEP / DCS CHRG / POST SLEEP / REBA-T / L/EMU BATT / BSA-I / EVA PROC REVW / HACK SAW ASMBLY / HACK PRAC / DCS FMT / CREW PHOTO / CREW CONF / MEAL / EVA TOOL CONFG / EMU H2O RCHG / PAO EVENT
STS-114 MS4 LAWRENCE	SLEEP / SALIVA / LOG / POST SLEEP / XFER REVIEW / LIOH XCHG / EVA PROC REVW / EVA3 DOUG RVW / EXERCISE / P/TV05 S/U / CREW PHOTO / CREW CONF / MEAL / SSRMS ESP2 GRPL / ESP2 UNBRTH / TRANSFER / PAO EVENT
STS-114 MS5 CAMARDA	SLEEP / SALIVA / LOG / POST SLEEP / XFER REVIEW / EXERCISE / TRANSFER / CREW PHOTO / CREW CONF / MEAL / TRANSFER / PRLA / TRANSFER / PAO EVENT
ISS CDR KRIKALEV	SLEEP / POST SLEEP / DPC / ♣ / XFER REVIEW / TRANSFER / TVIS / CREW PHOTO / CREW CONF / ⊕ / MIDDAY-MEAL / TRANSFER / СОЖ / VELO + HC / PAO EVENT
ISS FE-1 PHILLIPS	SLEEP / POST SLEEP / DPC / PREP WORK / ♦ / TVIS / EXERCISE RED / TRANSFER / CREW PHOTO / CREW CONF / ⊕ / MIDDAY-MEAL / TRANSFER / BOOSTER FAN DTO / PAO EVENT

DAY/NIGHT

ORBIT: 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111

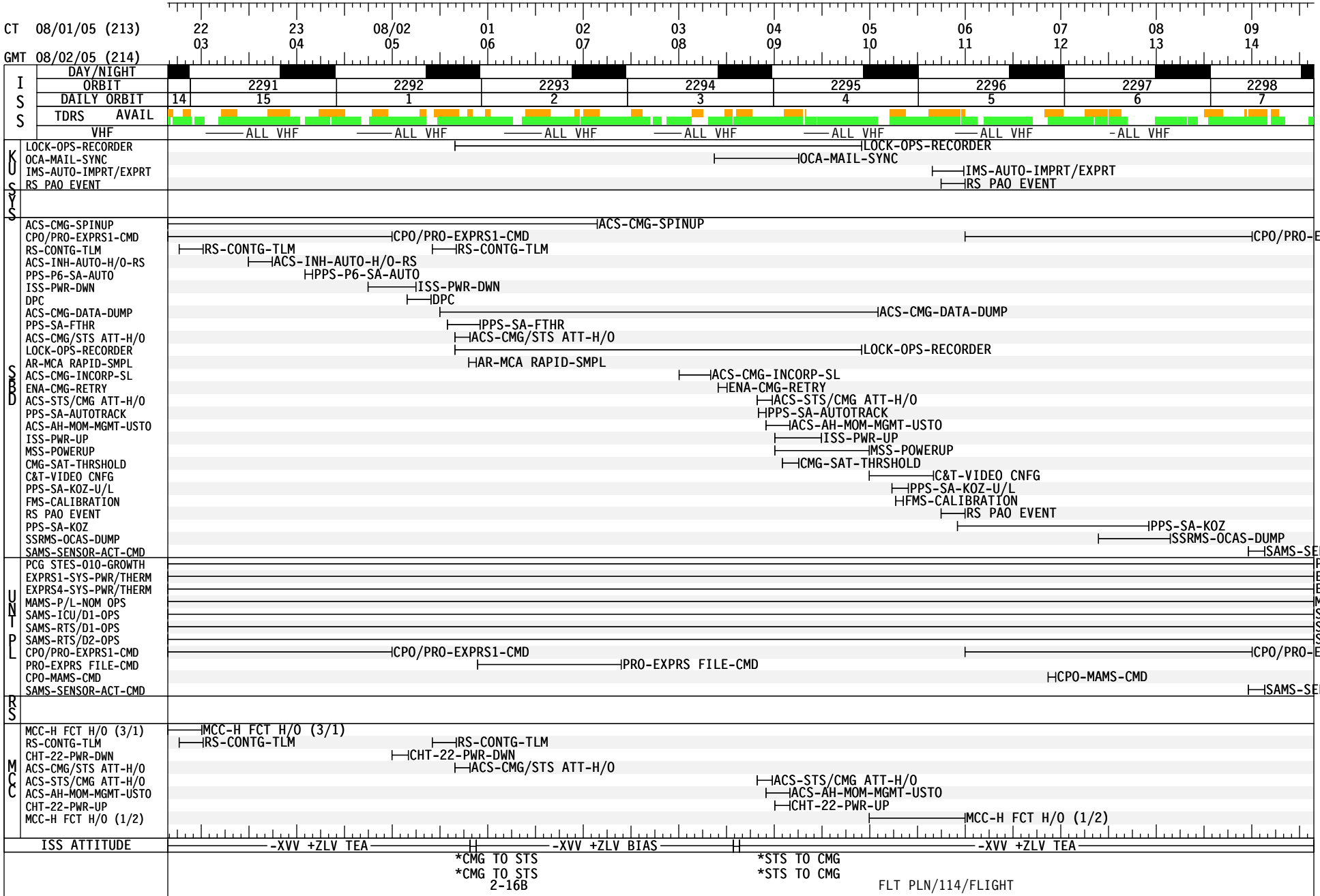
TDRS: E -46.0 / W -171.0 / Z -275.0

ORB ATT: BIAS -XLV -ZVV / DUMP BIAS / BIAS -XLV -ZVV

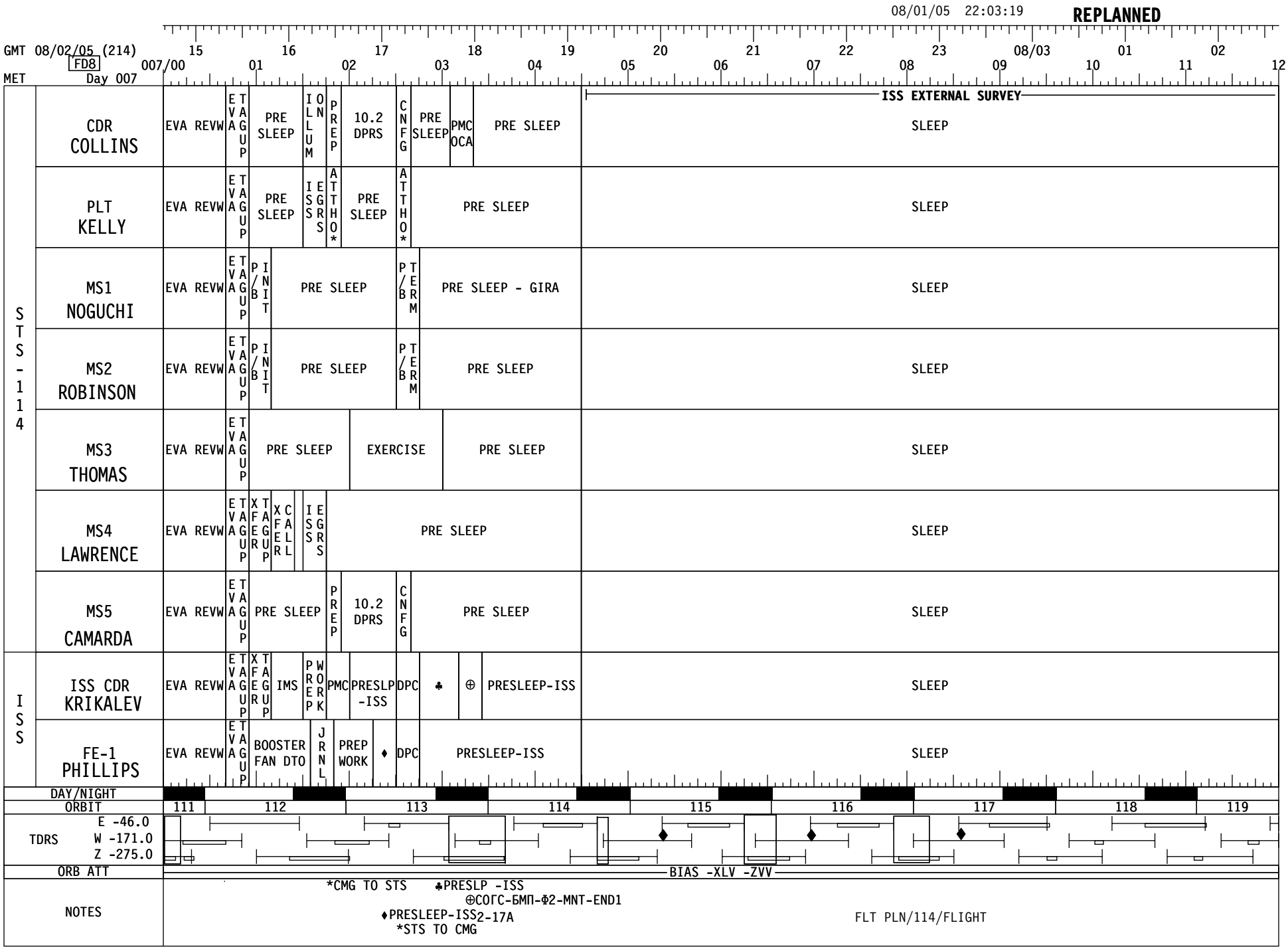
NOTES:
♣СОГС-БМП-Ф2-MNT-10
♦ECS-DPRS-PMP-REINSTL
*CMG TO STS
*STS TO CMG
⊕RS PAO EVENT

08/01/05 22:03:19

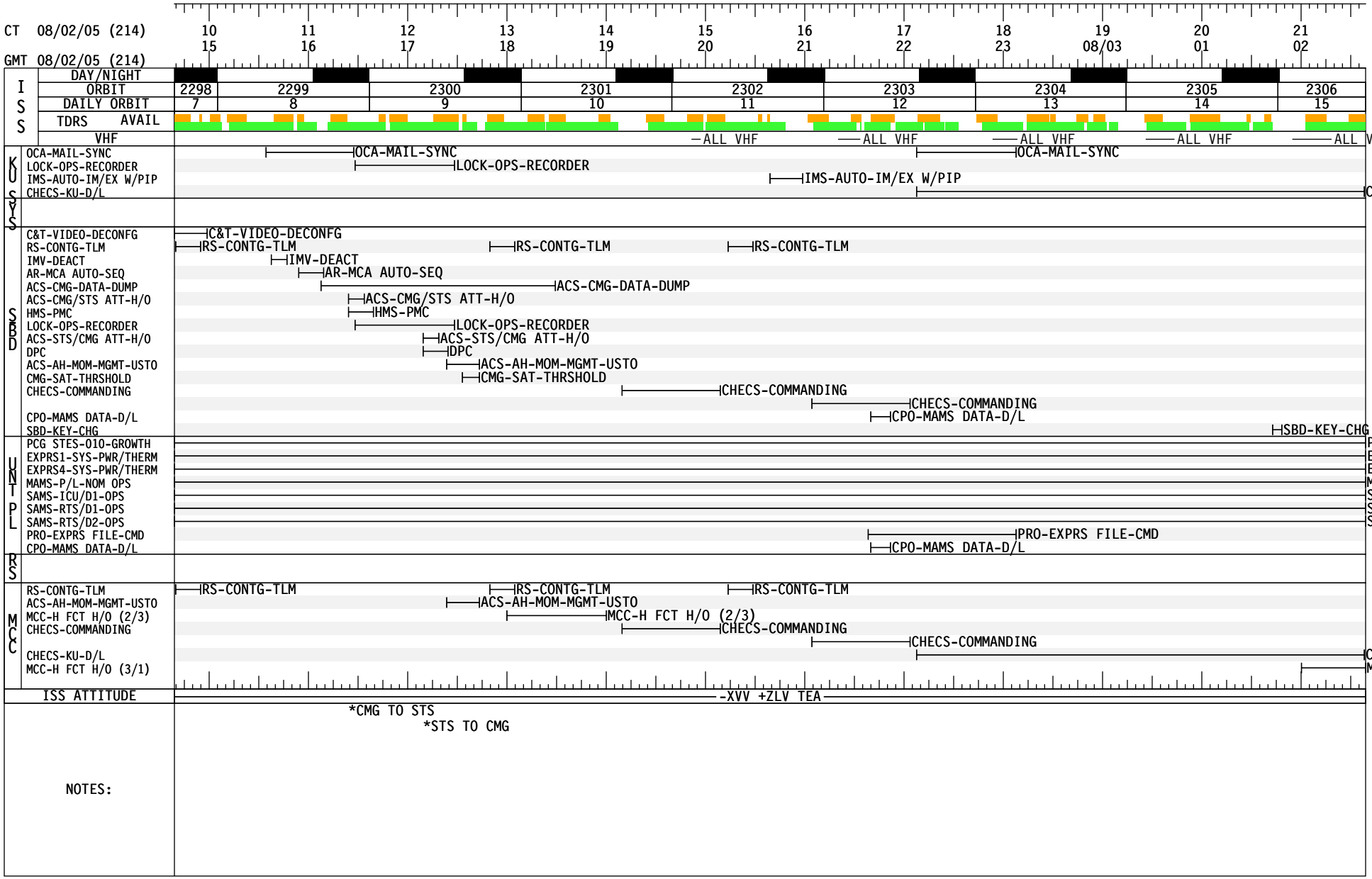
ISS-11 SHORT TERM PLAN PAYLOAD PAGE



NOTES:


08/01/05 22:03:19
REPLANNED
GMT 08/02/05 (214)
FD8
MET Day 007
007/00
15 16 17 18 19 20 21 22 23 08/03 01 02 03 04 05 06 07 08 09 10 11 12
STS-114
CDR COLLINS
EVA REVW
ETVA
AGUP
PRE SLEEP
ILLUM
ON
PREP
10.2 DPRS
CNFG
PRE SLEEP
PMC OCA
PRE SLEEP
ISS EXTERNAL SURVEY
SLEEP
PLT KELLY
EVA REVW
ETVA
AGUP
PRE SLEEP
ISS
EGRS
ATTHO*
PRE SLEEP
ATTHO*
PRE SLEEP
SLEEP
MS1 NOGUCHI
EVA REVW
ETVA
AGUP
P/B
INIT
PRE SLEEP
P/B
TERM
PRE SLEEP - GIRA
SLEEP
MS2 ROBINSON
EVA REVW
ETVA
AGUP
P/B
INIT
PRE SLEEP
P/B
TERM
PRE SLEEP
SLEEP
MS3 THOMAS
EVA REVW
ETVA
AGUP
PRE SLEEP
EXERCISE
PRE SLEEP
SLEEP
MS4 LAWRENCE
EVA REVW
ETVA
AGUP
XFER
TAGUP
XFER
CALL
ISS
EGRS
PRE SLEEP
SLEEP
MS5 CAMARDA
EVA REVW
ETVA
AGUP
PRE SLEEP
PREP
10.2 DPRS
CNFG
PRE SLEEP
SLEEP
ISS
ISS CDR KRIKALEV
EVA REVW
ETVA
AGUP
XFER
TAGUP
IMS
PREP
WORK
PMC
PRESLP -ISS
DPC
♣
⊕
PRESLEEP-ISS
SLEEP
FE-1 PHILLIPS
EVA REVW
ETVA
AGUP
BOOSTER FAN DTO
JRNL
PREP WORK
♦
DPC
PRESLEEP-ISS
SLEEP
DAY/NIGHT
ORBIT
111 112 113 114 115 116 117 118 119
TDRS
E -46.0
W -171.0
Z -275.0
ORB ATT
BIAS -XLV -ZVV
NOTES
*CMG TO STS
♣PRESLP -ISS
⊕COГС-БМП-Ф2-MNT-END1
♦PRESLEEP-ISS2-17A
*STS TO CMG
FLT PLN/114/FLIGHT

ISS-11 SHORT TERM PLAN PAYLOAD PAGE



STS-114 LF1 (FD 08)

REPLANNED

GMT Date 08/02 (214) | MET Day 006 | STS ATI

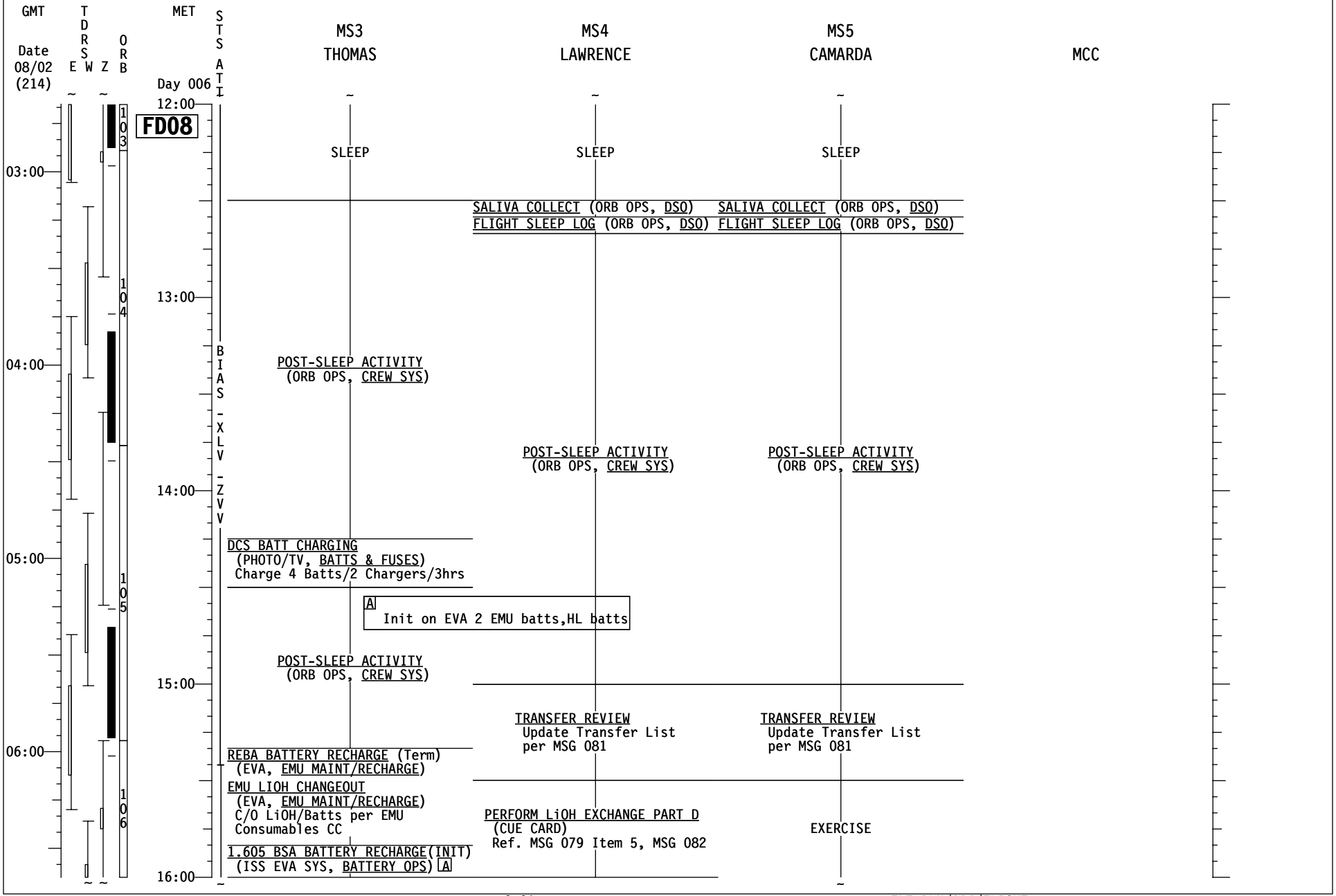
CDR COLLINS	PLT KELLY	MS1 NOGUCHI	MS2 ROBINSON	MCC
SLEEP	SLEEP	SLEEP	SLEEP	
	SALIVA COLLECT (ORB OPS, DSO)			
	FD08 EZ ACTIVITIES HARD REBOOT PGSC (not WLES) OCAC FILTER INSPECT TEPC (STATUS CK) (ORB OPS, CREW SYS) MCIU FILTER CK			
		POST SLEEP ACTIVITY (ORB OPS, CREW SYS)	POST-SLEEP ACTIVITY (ORB OPS, CREW SYS)	
POST-SLEEP ACTIVITY (ORB OPS, CREW SYS)	POST-SLEEP ACTIVITY (ORB OPS, CREW SYS)	GALLEY MORNING CONFIG (ORB OPS, ECLS)		
	CONFIG ODF DRAG THROUGHS			
			EXERCISE	
I'CNCT: R OMS to RCS (OPCL, RCS) A14 RCS/OMS HTR L POD (two) - A AUTO, B OFF 3.110 H/O ATT CONTROL CMG TO ORB (JOINT OPS, MATED OPS) MNVR (TRK) BIAS -XLV -ZVV TG=2 BV=5 P=155 Y=0 OM=205 A12/AUTO/VERN Init TRK		EXERCISE	POST-SLEEP ACTIVITY (ORB OPS, CREW SYS)	
SUPPLY/WASTE WATER DUMP (ORB OPS, ECLS) Init Ref. MSG 087 O2 REPRESS USING PL O2 VLV(INIT) (ORB OPS, ECLS) Steps 1-4,6	EXERCISE	TAKE 1 ASPIRIN (325mg) MIDDECK PREP (EVA, EVA PREP) Use HL batts per EMU Consumables CC	TAKE 1 ASPIRIN (325mg) MIDDECK PREP (EVA, EVA PREP) Use HL batts per EMU Consumables CC	UPDATE H2O WASTE DUMP QTY
SUPPLY/WASTE WATER DUMP (ORB OPS, ECLS) Term				

TDRS E W Z | ORB 103 104 105 106

BIAS -XLV -ZVV

STS-114 LF1 (FD 08)

REPLANNED



STS-114 LF1 (FD 08)

REPLANNED

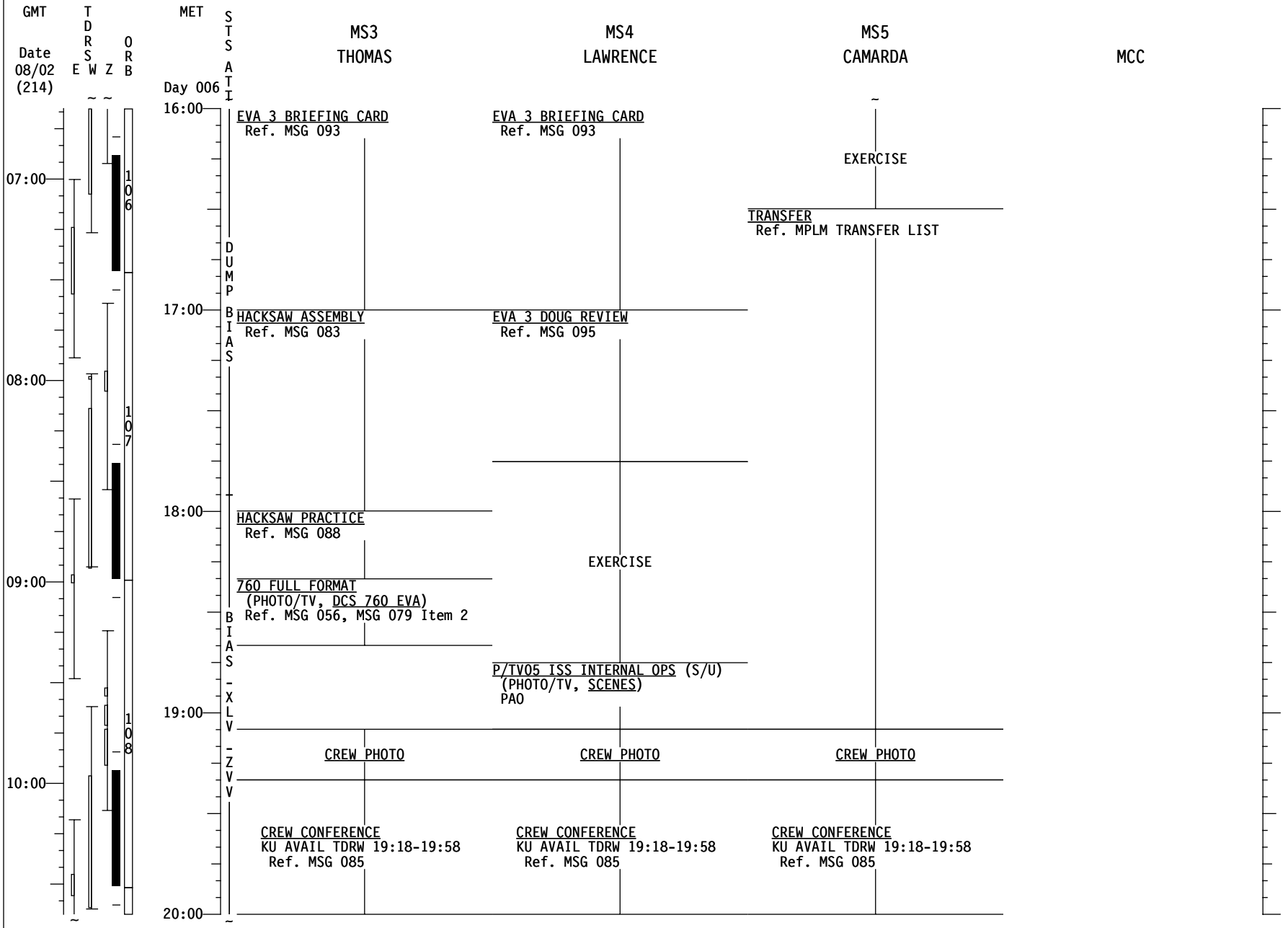
GMT Date 08/02 (214) | MET Day 006 | TDRS E W Z | ORB 106 107 108

STS ATT: DUMP BIAS -XLV -ZVV BIAS

CDR COLLINS	PLT KELLY	MS1 NOGUCHI	MS2 ROBINSON	MCC
16:00 SUPPLY/WASTE WATER DUMP (ORB OPS, ECLS) Terminate Waste Dump CWC OVERBOARD DUMP (INIT) (ORB OPS, ECLS) DUMP ISS CWC S/N 1027,1026 DUMP STS CWC S/N 6008 Ref. MSG 087	EVA 3 BRIEFING CARD Ref. MSG 093	EVA 3 BRIEFING CARD Ref. MSG 093	EVA 3 BRIEFING CARD Ref. MSG 093	
17:00	EVA 3 DOUG REVIEW Ref. MSG 095	HACKSAW ASSEMBLY Ref. MSG 083	HACKSAW ASSEMBLY Ref. MSG 083	
	TRANSFER Ref. MPLM TRANSFER LIST			
18:00 MNVR (TRK) BIAS -XLV -ZVV TG=2 BV=5 P=155 Y=0 OM=178 A12/AUTO/VERN Init TRK 3.111 H/O ATT CONTROL ORB TO CMG (JOINT OPS, MATED OPS) I'CNCT RETURN (OPS 2,3) (OPCL, RCS) O8 R OMS He PRESS/VAP ISOL A - OP After 30 sec: O8 R OMS He PRESS/VAP ISOL A - CL PWR FILL (ORB OPS, ECLS) Ref. MSG 087		HACKSAW PRACTICE Ref. MSG 088	HACKSAW PRACTICE Ref. MSG 088	
			760 FULL FORMAT (PHOTO/TV, DCS 760 EVA) Ref. MSG 056, MSG 079 Item 2	
		SETUP: 760 EVA-CAMR ONLY (PHOTO/TV, DCS 760 EVA) Use 28mm EVA Lens SETUP: 760 EVA-CAMR W/FLASH (PHOTO/TV, DCS 760 EVA) Use 50 mm EVA Lens		
19:00 CREW PHOTO	CREW PHOTO	CREW PHOTO	CREW PHOTO	
CREW CONFERENCE KU AVAIL TDRW 19:18-19:58 Ref. MSG 085	CREW CONFERENCE KU AVAIL TDRW 19:18-19:58 Ref. MSG 085	CREW CONFERENCE KU AVAIL TDRW 19:18-19:58 Ref. MSG 085	CREW CONFERENCE KU AVAIL TDRW 19:18-19:58 Ref. MSG 085	
20:00				

STS-114 LF1 (FD 08)

REPLANNED



STS-114 LF1 (FD 08)

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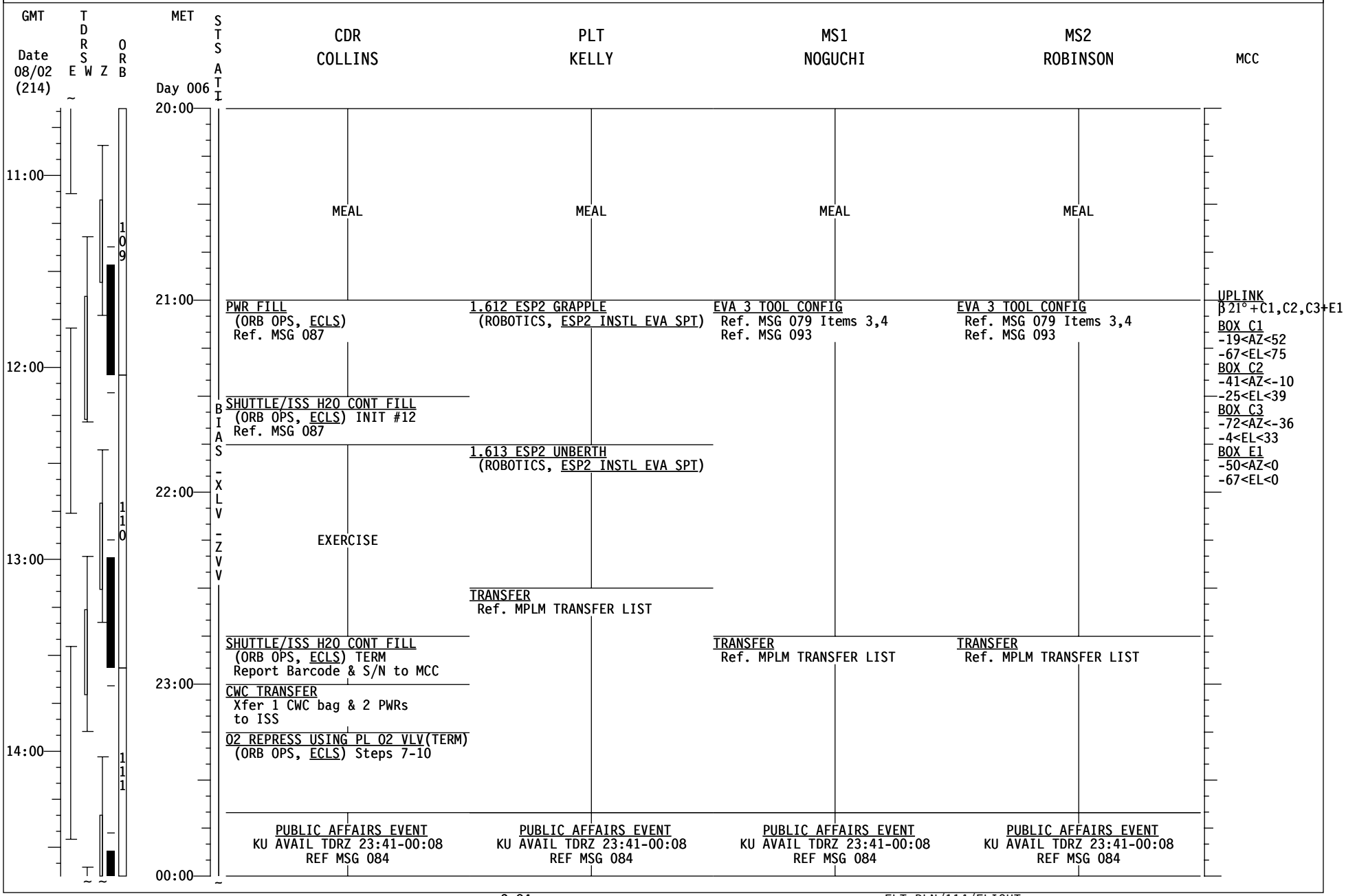

STS-114 LF1 (FD 08)

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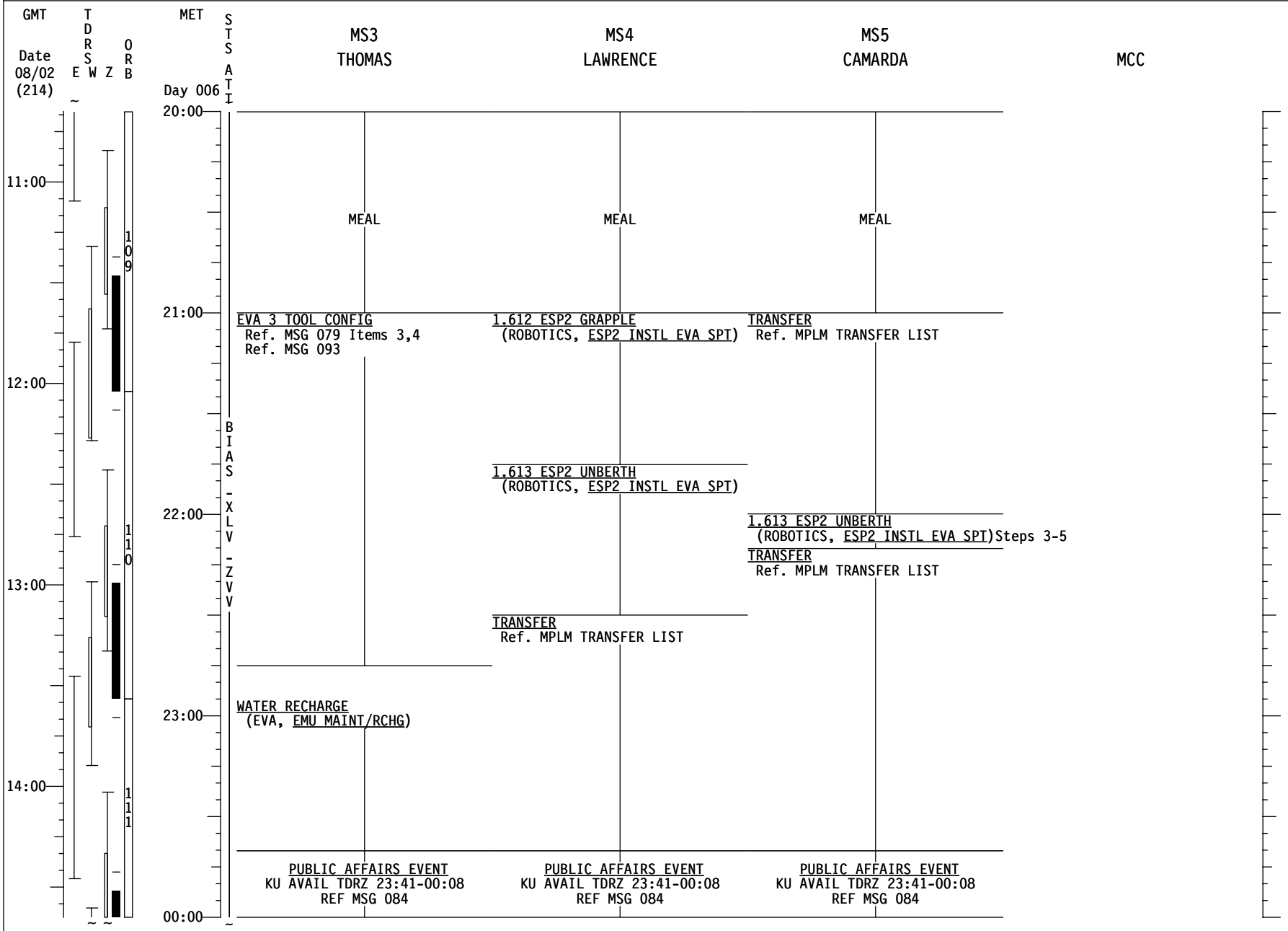

STS-114 LF1 (FD 08)

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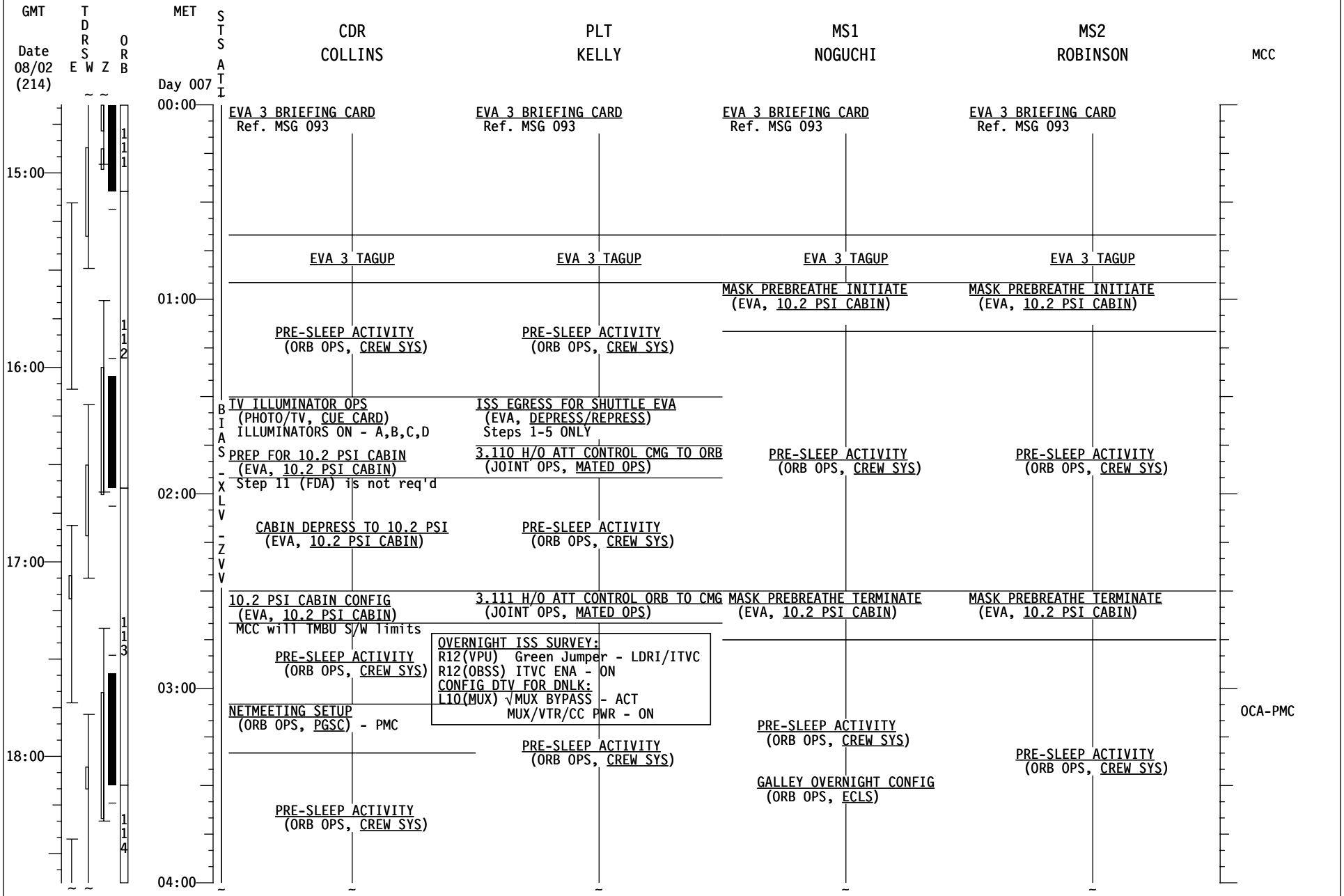

STS-114 LF1 (FD 08)

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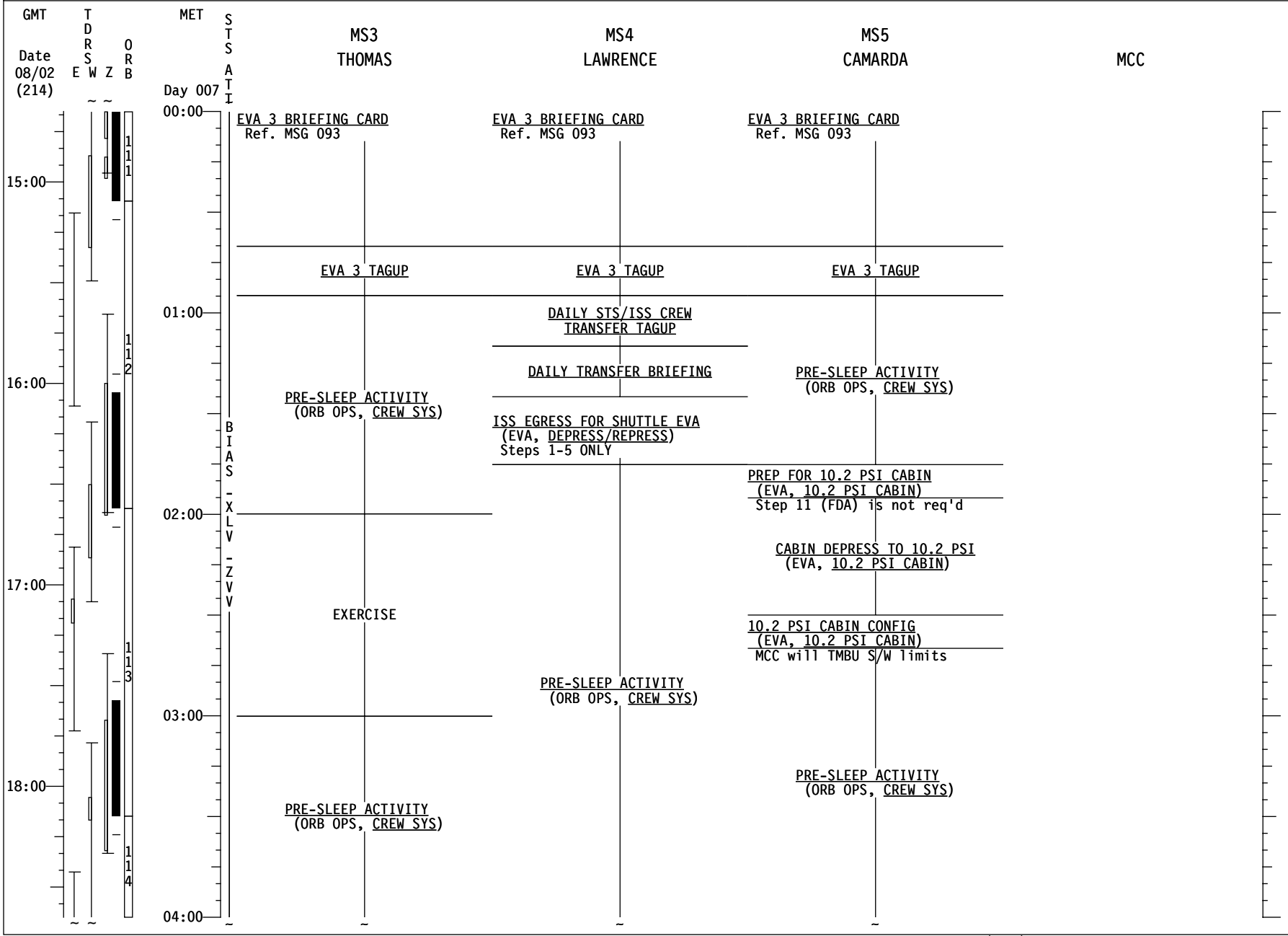
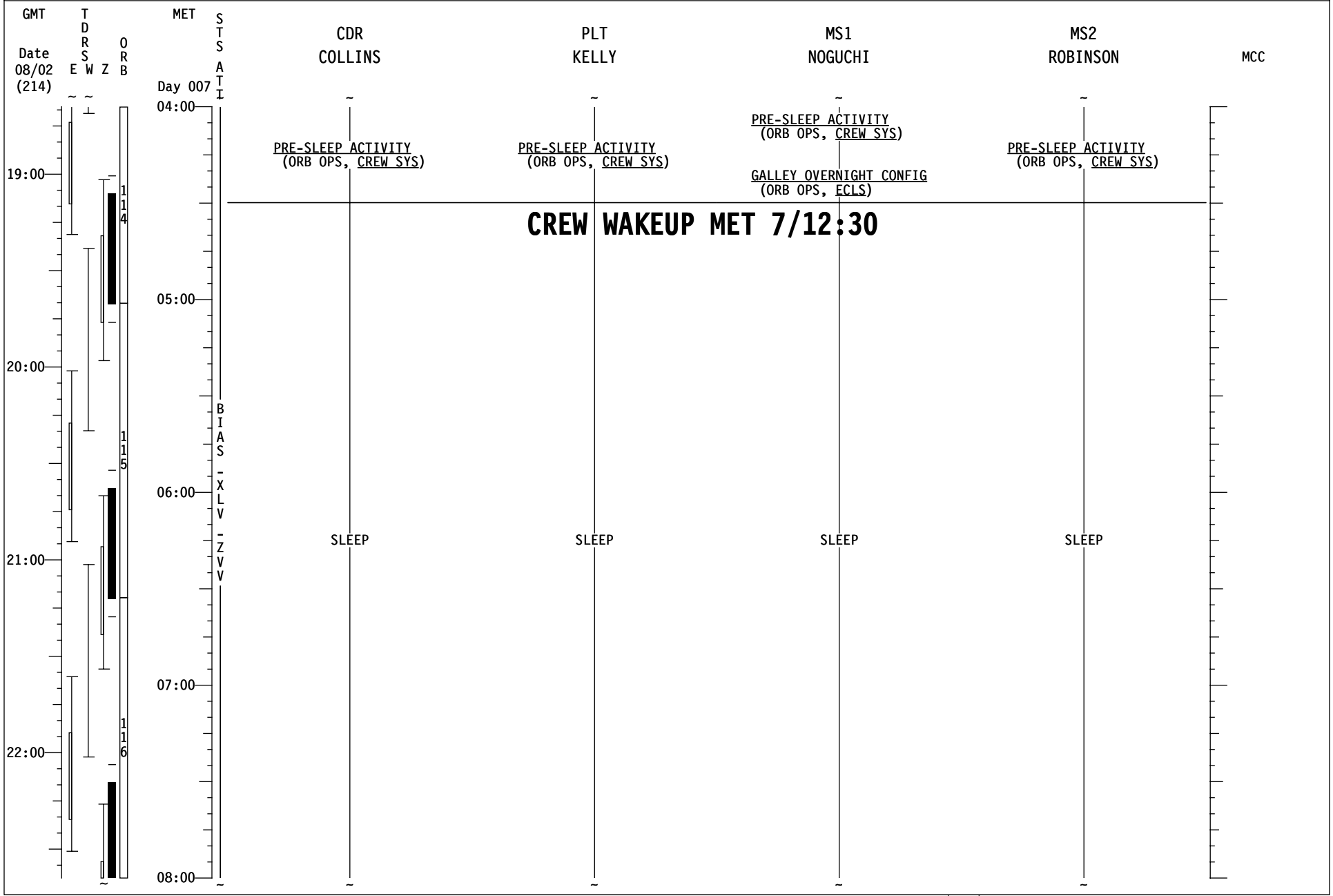


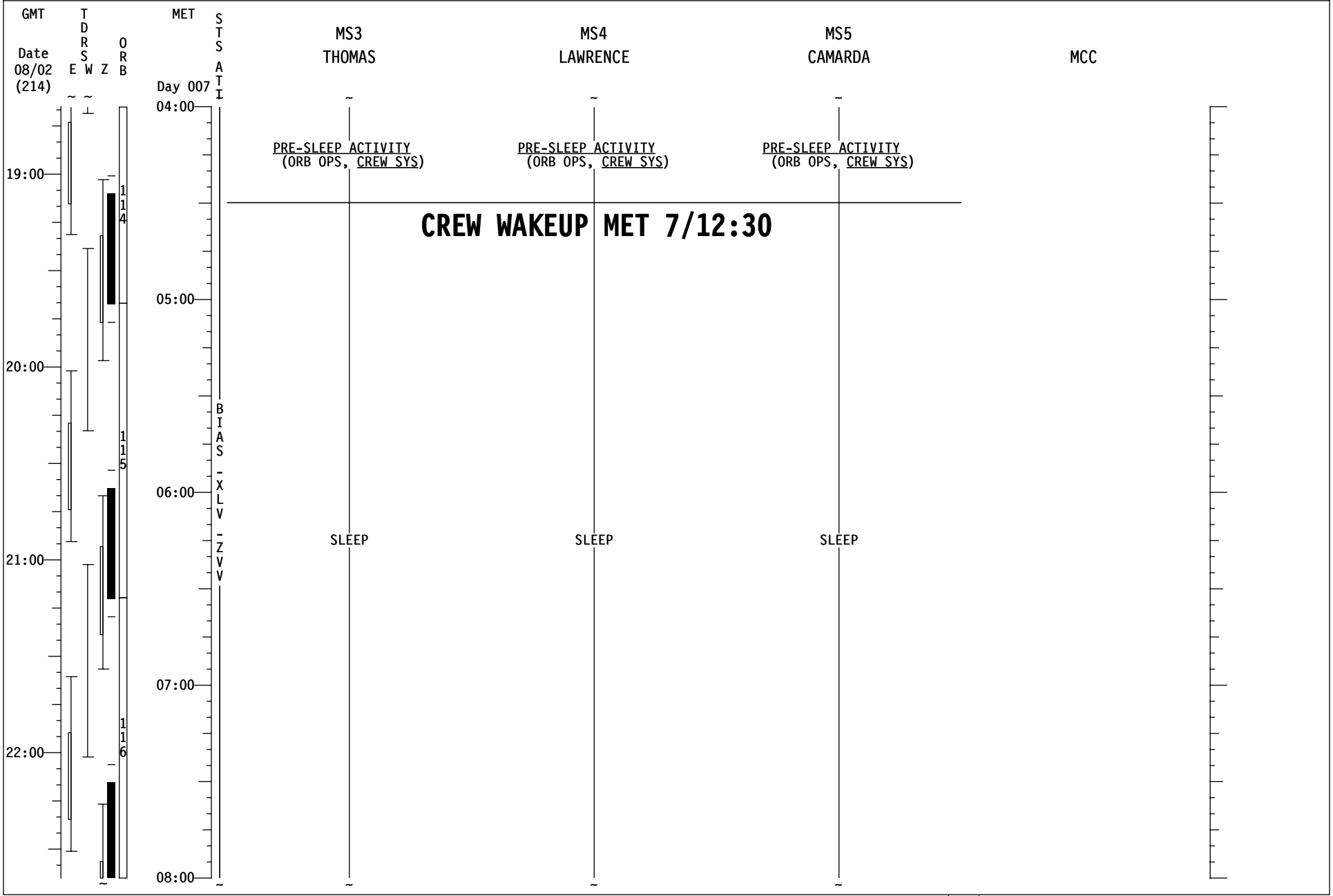
STS-114 LF1 (FD 08)

REPLANNED



STS-114 LF1 (FD 08)

REPLANNED



MSG 080A (11-0692A) - FD08 MISSION SUMMARY

Good Morning Discovery!

Yesterday you demonstrated that "you got the action and you got the motion!" Congratulations on another tremendous EVA.

When you review today's flight plan you will notice that transfer is now scheduled for the afternoon and off duty time has been deferred to Flight Day 10.

It has been decided to modify the EVA 3 timeline to include working on the protruding gap filler. As a result, today you will be reviewing the draft timeline for EVA 3 giving special thought to the added robotics and EVA tasks. If you have questions, ask. That is what we are here for!

Have a great day!

ISS Summary

CMG 1 was successfully activated and looks good. Please thank Soichi and Steve for their extra work on the connectors - the ADCO's are breathing again. We expect spin-up to be in progress when you awake.

YOUR CURRENT ORBIT IS: 193 X 188 NM

NOTAMS:

EDWARDS (EDW) - LAKEBED RWY 15 GREEN, RWY 18 UNCERTIFIED
WHITE SANDS (NOR) - GREEN
OCEANA (NTU) - RWY 23L/05R CLOSED
HALIFAX (YHZ) - RWY 06/24 CLOSED
GUAM (GUA) - RWY 06L/24R CLOSED
RIO GALLEGOS (AWG) - NOT APPROVED
ELMENDORF (EDF) - RWY 06/24 CLOSED
TINDAL (PTN) - TACAN TDL 70 UNUSABLE

NEXT 2 PLS OPPORTUNITIES:

EDW22 ORB 110 - 6/22:14
EDW22 ORB 126 - 7/22:41

OMS TANK FAIL CAPABILITY:

L OMS FAILS: NO
R OMS FAILS: NO

LEAKING OMS PRPLT BURN:

L OMS LEAK: ALWAYS BURN RETROGRADE
R OMS LEAK: ALWAYS BURN RETROGRADE

POST-TI OMS QUANTITIES(%)

L OMS OX = 35.2 R OMS OX = 36.6
FU = 35.6 FU = 37.3

SUBTRACT I'CNCT COUNTER FOR CURRENT OMS QUANTITIES

DELTA V AVAILABLE:	WITH MPLM	NO MPLM
OMS	327 FPS	312 FPS
ARCS (TOTAL ABOVE QTY1)	29 FPS	31 FPS
TOTAL IN THE AFT	356 FPS	343 FPS
ARCS (TOTAL ABOVE QTY2)	59 FPS	63 FPS
FRCS (ABOVE QTY 1)	30 FPS	32 FPS
AFT QTY 1	82 %	82%
AFT QTY 2	44 %	44%

SYSTEM	FAILURE	IMPACT	WORK AROUND
ECLS 1	At the end of EVA 2, depress through outer hatch equalization valve unexpectedly stopped.	None.	Crew was able to use redundant equalization valve to complete depress.
EVA 1	Right Angle Drive (RAD) bound up after 1 turn.	Could no longer use the RAD.	Used a 2" socket to finish task; Need to use different RAD for EVA3.
EVA 2	The port-most TSA latch would not release.	Could not open the TSA by nominal means.	Used the contingency bolt to release the latch; Reinstalled the bolt w/ PGT at the B2 setting.
EVA 3	EV2 MWS End Effector did not operate as expected.	N/A	If EV2 would like, a spare MWS Gimbal Assembly (T-Bar) can be retrieved from the ISS A/L.
EVA 4	EV1 prime left glove wrist tether loop has torn loose.	Tether point is no longer reliable for equipment restraint.	EV2 has the option of either remaining in the prime gloves for EVA 3 (tuck loop back under TMG) or swap to backup gloves. Inform MCC of config.

Good morning Wendy, Charlie, and crew!

All hail Transfer King Charlie! Just wanted to let you know what a high honor Wendy has bestowed on you! You are the first Transfer King!

The Transfer List Excel file, LF1_TransferList_FD08.xls, is located on the KFX machine in **C:\OCA-up\transfer.**

For ISS, the Transfer List Excel file, LF1_ TransferList_FD08.xls, is located in **K:\OCA-up\transfer.**

Transfer Notes

Tomorrow the MISSE clamps will be removed from MISSE PECs 1 and 2 per Transfer List items #725 and 726. The Notes column for these two items has been updated to stow these clamps with the collars that were stowed on FD04 (per crew calldown in A/LO1 in CTB S/N 1161).

We have also checked-off the MPLM Setup as complete since you are well into MPLM ops.

Changes to the Transfer List are noted below

MPLM Return List:

- Items 443.1 and 445.1: Items added (removes 1 pair of EMU gloves from each CTB).
- Item 718: LiOH single added back to MPLM Return in MPL2P2_K1.
- Item 723: LiOH triple deleted from MPL2S4_G1.
- Item 725 and 726: Notes added to items.
- Item 412 (in Real-time Additions): ARCU added to MPL2S4_G1 (previously lost Prepack Item).

P&I to MPLM Return Location Sort

Was: Item 723 – LiOH triple – MPL2S4_G1
Is: Item 412 – Return Bag 412 [ARCU] – MPL2S4_G1

Add: Item 718 – LiOH single – MPL2P2_K1

Questions

FYI - We would like to confirm the contents of Return Bag 807 and the items completed in Return Bag 482 during the call down tonight.

-The Transfer Team-

STS-114 / LF1 Return Transfer List

Chg Flag	☑	FD	Crew Initials	Item #	Item Name	Qty	Initial Stowage	Temp Stowage	Stowage at Undock	Tox Level	Wt (lbs)	PROCEDURES/**Constraints/** **Comments
	☑	7		441	Return Bag 441 [IRED Canister - Fore]	1 Dbl	NOD1P1		MPL2P2_K2	N/A	52.50	
				442	Return Item 442 [HEPA filter]	1	LAB1P1_C1		MPL2F3_C1	N/A	4.47	**Pack in filter foam that launched in this location. **Reference item 133 for launched filters.
X				443	Return Bag 443 [EMU Gloves-5pr]	1 Sngl	LAB1D5		MPL2F4_H1	N/A	38.85 ~~47.25~~	
X				443.1	EMU Gloves (S/N 6068)	1 pr	LAB1D5 (inside item 443)		A/L1O1 (in M-02 bag)	N/A	delete from above	**Remove 1 pair of EMU gloves (S/N 6068) from Bag 443 and leave on ISS.**
	☑	7		444	Return Bag 444 [EMU Gloves]	1 Hlf	NOD1O1		MPL2S4_K1	N/A	19.00	
X				445	Return Bag 445 [EMU Gloves]	1 Sngl	LAB1D5		MPL2P2_K2	N/A	29.2 ~~37.6~~	
X				445.1	EMU Gloves (S/N 6039)	1 pr	LAB1D5 (inside item 443)		A/L1O1 (in M-02 bag)	N/A	delete from above	**Remove 1 pair of EMU gloves (S/N 6039) from Bag 445 and leave on ISS.**
	☑	7		446	Return Bag 446 [Pump Package Assembly]	1	LAB1D1 (Behind Rack)		MPL2A4_C1	0	190.60	
	☑	7		447	Return Bag 447 [RS Data Bank]	1 Sngl	FGB Deck		MPL2F3_A1	N/A	36.41	
				453	Return Item 453 [Elektron Liquid Unit]	1	NOD1P4		MPL2F4_A1	BA-2	330.00	**To stow Elektron in M-bag, remove middle back piece of foam and one portion of front foam and stow in any RSR location for return. Ensure all straps & zippers on M-bag are fully secure for return.**
	☑	7		454	Return Item 454 [FOOD CONTAINERS]	20	NOD1S4_D1/E1		MPL2P3_G2*	N/A	44.00	
				455	Return Item 455 [Food Containers]	17	NOD1D4_K2		MPL2A1_H1	N/A	37.40	
	☑	7		456	Return Item 456 [Food Containers]	20	NOD1D4_K2		MPL2S3_D1*	N/A	44.00	
	☑	7		457	Return Item 457 [Water Sampler and Archiver]	1	NOD1O1		MPL2P3_D2	0	33.00	

[ ] - indicates note added by Transfer Team (not seen on actual label)
* in Stowage at Undock - indicates items that do not return if ESP-2 not installed on ISS
[ ] in Stowage Locations - indicates prior stowage locations

STS-114 / LF1 Return Transfer List

Chg Flag	☑	FD	Crew Initials	Item #	Item Name	Qty	Initial Stowage	Temp Stowage	Stowage at Undock	Tox Level	Wt (lbs)	PROCEDURES/**Constraints/** **Comments
	☑	7		717	LiOH (1)	1 Hlf		Middeck (LiOH Box)	MPL2P3_D1*	2	11.50	**For Wendy and Charlie only. Reference LIOH CUE CARD
X				718	LiOH (2)	1 Sngl		Middeck (LiOH Box)	MPL2P2_K1	2	22.63	**For Wendy and Charlie only. Reference LIOH CUE CARD
				719	LiOH (2) [S/N 336 and 334]	1 Sngl	See Swap List		MPL2P3_K1	2	22.63	**Reference Swap List for instructions.
	☑	7		720	LiOH (2) [STS-111 65 and STS-111 59]	1 Sngl	NOD1D4_D2		MPL2F1_A1	2	22.63	**For Wendy and Charlie only. Reference LIOH CUE CARD **Expired and used canisters. **Retrieve single CTB (or two half CTBs) from ISS. **Report CTB B/C to MCC-H**
	☑	7		721	LiOH (6)	1 Trpl		Middeck (LiOH Box)	MPL2P2_G1	2	65.00	**For Wendy and Charlie only. Reference LIOH CUE CARD. **Use triple CTB launched in MPLM for packing LiOH. Reference item 132.
				722	LiOH (6)	1 Trpl		Middeck (LiOH Box)	MPL2P3_K2	2	65.00	**For Wendy and Charlie only. Reference LIOH CUE CARD **Use triple CTB launched in MPLM for packing LiOH. Reference item 132.
X				723	Item deleted ~~LiOH (6)~~	~~1 Trpl~~		~~Middeck (LiOH Box)~~	~~MPL2S4_G1~~	~~2~~	~~65.00~~	~~**For Wendy and Charlie only.~~ ~~Reference LIOH CUE CARD~~ ~~**Use triple CTB launched in MPLM for packing LiOH. Reference item 132.~~

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[ ] in Stowage Locations - indicates prior stowage locations

STS-114 / LF1 Return Transfer List

Chg Flag	☑	FD	Crew Initials	Item #	Item Name	Qty	Initial Stowage	Temp Stowage	Stowage at Undock	Tox Level	Wt (lbs)	PROCEDURES/**Constraints/** **Comments
				724	Mineral Syringe Kit [S/N 1001]	1 Zplk	[MPL2S3_A1]	Middeck	MPL2P2_A1	0	4.14	**Mineralization kit used on Middeck. Stow after ops complete on FD09. **Reference item 154 for resupply item.
X				725	MISSE PEC #1 with Wrapper	1	Brought in from EVA		MPL2F1_C1	0	75.62	**Transfer after EVA 3.** **Place MISSE PEC #1 into one inner bag for return.** **Clamps do NOT return on LF1. Remove pip pin to release clamp. Stow clamps with the two collars brought up on LF1 in CTB #1161 in A/L1O1 ~~half CTB stowed in NOD1O4_E2~~ (reference item 38 and 39).**
X				726	MISSE PEC #2 with Wrapper	1	Brought in from EVA		MPL2F1_C1	0	62.39	**Transfer after EVA 3.** **Place MISSE PEC #2 into one inner bag for return.** **Clamps do NOT return on LF1. Remove pip pin to release clamp. Stow clamps with the two collars brought up on LF1 in CTB #1161 in A/L1O1 ~~half CTB stowed in NOD1O4_E2~~ (reference item 38 and 39).**
				727	OUTER HATCH WINDOW COVER ASSEMBLY	1	See Swap List		MPL2A4_C1	N/A	3.00	**Reference Swap List for instructions.
				728	Pettit Return #1 [S/N 1189]	1 Sngl	LAB1P4_Aft (Returning ZSR)		MPL2F4_H1	N/A	20.00	
				729	Pettit Return #2 [S/N 1050]	1 Sngl	LAB1P4_Aft (Returning ZSR)		MPL2S3_B1	N/A	30.00	

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[ ] in Stowage Locations - indicates prior stowage locations

STS-114 / LF1 Return Transfer List

Chg Flag	☑	FD	Crew Initials	Item #	Item Name	Qty	Initial Stowage	Temp Stowage	Stowage at Undock	Tox Level	Wt (lbs)	PROCEDURES/**Constraints/** **Comments
			MPLM Real-Time Additions									
				706	SAFER [S/N 1003]	1	ISS A/L (in SAFER Stowage Bag)		MPL2S3_K1	1	72.10	**Remove SAFER from Stowage Bag and then transfer.** **Stow switchguard from launched SAFER on this returning SAFER Hand Controller. Stow Hand Controller deployed, inhibitor installed.** **Remove and trash old 'SAFER Checkout Results Cue Card'.** ****Ref Safer Drawing in MSG 051 for correct orientation. Cut side piece of SAFER foam to fit in RSR. **Item moved from Middeck Return to MPLM Return.
				801	EVA Large Trash Bag [S/N 1002]	1	Tool Pregather CTB		MPL2S3_D2	TBD	3.60	
				804	Return Item 804 KURS Electronics Unit	1	FGB Deck		MPL2A3_K1	N/A	149.91	**S/N of returning KURS to be provided by MCC-M. **Use triple CTB launched in MPLM for packing KURS. Reference item #163.
				805	Respiratory Support Pack (RSP) [S/N 1004]	1	LAB1D4_D1		MPL2S4_D1*	TBD	9.8	**Do not stow unil RSP ops complete per timeline.**
				806	HEPA Filter	3	ISS Installed		MPL2S4_K1	0	4.47	**Do not stow unil R&R'd per timeline.**
X				412	Return Bag 412 ARCU [S/N 93040014]	1 Sngl			MPL2S4_G1	TBD	35.28	**Report barcode of the CTB used.

[ ] - indicates note added by Transfer Team (not seen on actual label)
* in Stowage at Undock - indicates items that do not return if ESP-2 not installed on ISS
[ ] in Stowage Locations - indicates prior stowage locations

FLIGHT DAY 3 DOCKING
ORBITER with ISS
CO2 ABSORBER REPLACEMENT
(7 Crewmembers/Single Shift/FD1-16)

			STOWAGE LOCATION		CK CMPLT
FLIGHT DAY	POS A	POS B	PRE DOCK	POST UNDOCK	
Launch	STS-114 1	STS-114 2	Installed	MPLM	2
PRE FD1	"	"			
POST FD2	STS-114 3	STS-114 4	LiOH Box	MPLM	
PRE FD2	STS-114 5	"	LiOH Box	MPLM	
POST FD3 (Docking)	STS-114 6	STS-114 7	LiOH Box	MPLM	
PRE FD3	"	STS-111 60	NOD1D4_D2	MPLM	
POST FD4 (MPLM)	STS-111 61	STS-111 62	NOD1D4_D2	MPLM	
PRE FD4	STS-113 29	STS-113 35	NOD1D4_D2	MPLM	
POST FD5 (EVA1)	STS-113 36	STS-113 37	NOD1D4_D2	MPLM	
PRE FD5	STS-111 63	STS-111 64	NOD1D4_D2	MPLM	
POST FD6	STS-111 66	"	NOD1D4_D2	MPLM	
PRE FD6	STS-113 23	STS-113 24	NOD1S4_F2	LiOH Box	
POST FD7 (EVA2)	STS-113 25	STS-113 26	NOD1S4_F2	LiOH Box	
PRE FD7	STS-113 27	STS-113 28	NOD1S4_F2	LiOH Box	
POST FD8	"	STS-113 ___	NOD1P4	LiOH Box	1
PRE FD8	STS-113 ___	STS-113 ___	NOD1P4	LiOH Box	
POST FD9 (EVA3)	"	"			
PRE FD9	STS-113 ___	"	LABP4_F1	LiOH Box	
POST FD10 (MPLM)	"	"			
PRE FD10	"	STS-112 ___	NOD1P4_B1	LiOH Box	
POST FD11 (MPLM)	"	"			
PRE FD11	STS-112 ___	"	NOD1P4_B1	LiOH Box	
POST FD12 (Undock)	"	STS-112 ___	NOD1P4_B1	LiOH Box	
MID FD12	STS-112 ___	"	NOD1P4_B1	LiOH Box	1
PRE FD12	"	STS-114 21	LiOH Box	LiOH Box	
POST FD13	STS-112 ___	STS-112 ___	NOD1P4_B1	LiOH Box	
PRE FD13	STS-114 22	"	LiOH Box	LiOH Box	
POST FD14 (EOM)	STS-114 23	STS-114 24	LiOH Box	LiOH Box	
PRE FD14	STS-114 25	STS-114 26	LiOH Box	LiOH Box	
POST FD15 (EOM+1)	STS-114 27	STS-114 28	LiOH Box	LiOH Box	
PRE FD15	"	STS-114 29	LiOH Box	LiOH Box	
POST FD16 (EOM+2)	STS-114 30	STS-114 31	LiOH Box	Installed	

Notes:
1. STS-111, 112, and 113 denotes any LiOH can from those three flights
2. Report LiOH can decal number for LiOH cans used at each LiOH changeout to MCC
3. Record LiOH can decal numbers in the space provided for the STS-111 ___, 112 ___, and 113 ___ LiOH cans
4. The STS-111, 112, and 113 LiOH cans will have black decals with white text with no Used checkbox
5. The STS-114 LiOH cans will have white decals with black text
6. See Transfer List for MPLM LiOH can final stowage locations
7. Reseal all LiOH cans w/ Gray Tape and stow
8. For STS-114 LiOH cans, place a √ in the box next to the word “Used” to indicate the LiOH can has been used.
9. Place Kapton tape on STS-111, STS-112, and STS-113 LiOH cans and mark “USED”
10. Location of canisters and LiOH Exchange plan on back

BACK OF FLIGHT DAY 3 DOCKING
ORBITER with ISS
CO2 ABSORBER REPLACEMENT

LIOH CANISTER STOWAGE LOCATIONS
(Predocking and Post Undocking)

ORB + MPLM LIOH STOWAGE LOCATIONS

	PRE DOCK	POST UNDOCK	NOTES
STS 114 1 - 7	LiOH Box	MPLM	Transfer on FD5
STS 114 8 - 14	LiOH Box	NOD1S4_D/E/F2	Transfer on FD3
STS-114 15 – 20	LiOH Box	ISS	Transfer on FD8
STS-114 21 - 31	LiOH Box	LiOH Box	No Transfer
STS 114 32 - 47	MPLM	FGB Floor	Transfer on FD5/FD6
STS 114 48	MPLM	NOD1P4_B2	Transfer on FD6
STS 114 49	MPLM	CM1PO_4_417_1	Transfer on FD6

ISS LIOH STOWAGE LOCATIONS

	PRE DOCK	POST UNDOCK	NOTES
S/N 334	CM1PO_4_417_1	MPLM	No Flight # on Decal, Transfer on FD6
S/N 336	NOD1P4_B2	MPLM	No Flight # on Decal, Transfer on FD6
STS-111 65	NOD1D4_D2	MPLM	LiOH can used on the ISS, Transfer on FD5
STS-111 59	NOD1D4_D2	MPLM	LiOH can used on the ISS, Transfer on FD5
STS-111 60 - 64, 66	NOD1D4_D2	MPLM, LiOH Box	4 return in MPLM, 2 in LiOH Box
STS-112 25 - 31	NOD1P4_B1	LiOH Box	
STS-113 23 - 28	NOD1S4_F2	LiOH Box	
STS-113 29	NOD1D4_D2	MPLM	
STS-113 30 - 31	LAB1P4_F1	LiOH Box	
STS-113 32 - 34	NOD1P4	LiOH Box	
STS-113 35 - 37	NOD1D4_D2	MPLM	

LiOH Exchange Plan		
FD3:	A	1. LiOH Box: STS-114 cans 8-14 to NOD1S4_D/E/F2 2. NOD1D4_D2: 3 STS-111 cans plus 4 STS-113 cans to the LiOH Box
FD5:	B	1. LiOH Box: STS-114 cans 1-7 (used) to the MPLM 2. NOD1D4_D2: 2 ISS used STS 111 cans to the MPLM 3. NOD1D4_D2: 3 STS-111 cans to the LiOH Box 4. NOD1S4_F2: 4 STS-113 cans to the LiOH Box 5. MPLM: 16 STS 114 LiOH cans to FGB Floor between FD5 and FD6
FD6:	C	1. LiOH Box: 4 used STS-111 and 4 used STS-113 LiOH cans from the LiOH Box to the MPLM 2. NOD1S4_F2: 2 STS 113 LiOH cans to the LiOH box 3. NOD1P4: 3 STS-113 LiOH cans to the LiOH Box 4. LAB1P4_F1: 2 STS-113 LiOH cans to the LiOH Box 5. NOD1P4_B1: 1 STS-112 LiOH cans to the LiOH Box 6. MPLM: 16 STS 114 LiOH cans to FGB Floor (if not complete on FD5) 7. NOD1P4_B2 (Post Fire Cleanup Kit): 1 LiOH can (No Flight Decal) to the MPLM 8. CM1PO_4_417_1 (Post Fire Cleanup Kit): 1 LiOH can (No Flight Decal) to the MPLM 9. MPLM: 1 STS 114 LiOH can to NOD1P4_B2 (Post Fire Cleanup Kit), report Decal and S/N to MCC-H 10. MPLM: 1 STS 114 LiOH can to CM1PO_4_417_1 (Post Fire Cleanup Kit), report Decal and S/N to MCC-H
FD8:	D	1. LiOH Box: STS-114 cans 15 – 20 to ISS NOD1D4_D2 2. NOD1P4_B1: 6 STS-112 Cans to the LiOH Box

HACKSAW ASSEMBLY

REV F
(00:45 MIN)

OBJECTIVE: Assemble hacksaw for EVA tile gap filler removal

TOOLS REQD:

Tool	Hacksaw
	Gray Tape 1-inch width
	Long screw driver
	2-inch by 2-inch Velcro
	Hacksaw blades
	Zip Ties
	Tape Measure
	Wire Cutters
EVA Tools	RET (Retractable Equipment Tether)
FDF Cont	Sharpie

1. Remove blade from Hacksaw (Long screw driver)

NOTE:
Blade will be bent differently depending on right or left handed operation.
All pictures show hacksaw configured for right handed operation.
For left handed operation the bend 2 will be on the other end of blade.
Too much bend may increase difficulty in cutting, less bend is better.

NOTE
Keep in mind to only bend blade once during next step. Repeated bend cycles will fatigue blade.

2. Mark middle of blade (Sharpie) and make first bend (~15 degrees) in blade as shown in Fig. 1
Use inner-deck access ladder uprights to bend blade around

Fig. 1

3. Make 2nd bend in tip of blade approximately ¾-inch long as shown in Fig. 2

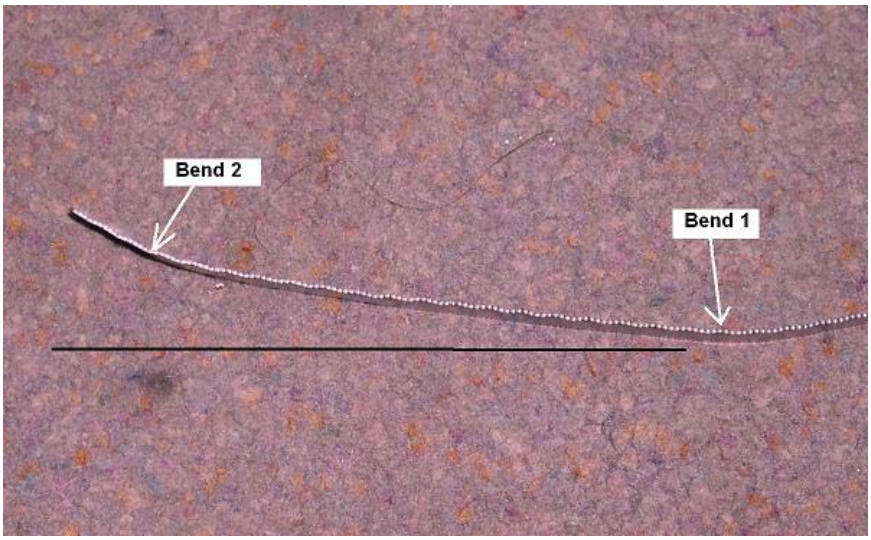


Fig. 2

4. Insert blade into handle and tighten set screw as seen in Fig. 3. (Long screw driver). Thermal expansion may cause set screw to loosen while EVA. Tighten very tight

Fig. 3

5. Wrap Gray tape around length of blade between set screw and handle

6. Wrap Gray tape around blade, set screw, and finger guard as shown in Fig. 4

Fig. 4

7. Attach non-reel end of RET with zip tie as shown in Fig. 5

Fig. 5

8. Gray tape over zip tie as shown in Fig. 6

Fig. 6

9. Wrap tape around (~ six times) tip of blade as shown in Fig. 7

Fig. 7

10. Fold Velcro over Gray Tape as shown in Fig. 8

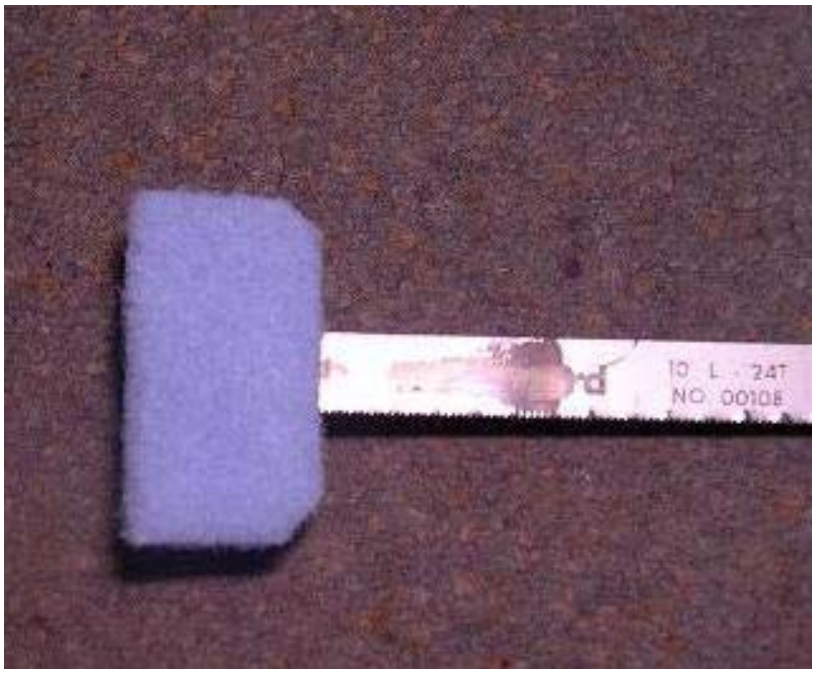
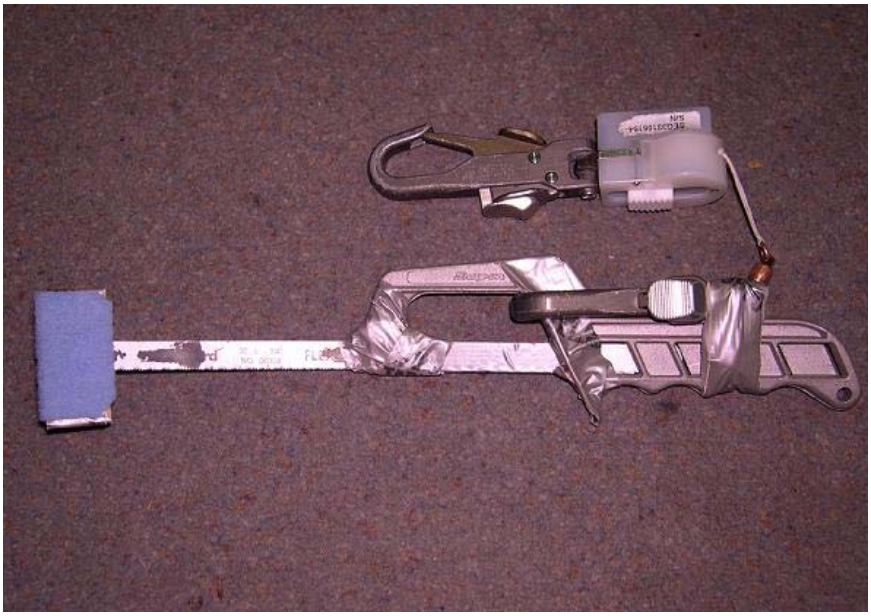


Fig. 8

11. IVA hacksaw complete



RCC PLUG REPAIR DEMO (IVA) (Replaces pages FS 8-44 to FS 8-46 of the EVA Checklist) |

HARDWARE STAGING

NOTE
For the middeck camcorder setup, do not use Lav microphone

1. Set up video per SINGLE CAMCORDER w/CAMCORDER MICROPHONE (PHOTO/TV, SONY PD100)
2. Set up IVA Plug Demo Panel (MD Floor port 2) per crew preference, ensure 3 and 9 o'clock sides are unobstructed for t-bar clearance
3. Retrieve the following tools and equipment:

PGT S/N _____	STS Airlock
PGT Battery S/N _____	STS Airlock
RET w/PIP pin	STS Airlock
3/8-inch to 1/4-inch adapter	IFM tray 3, MF14G
5/32-inch Ball Tip Hex Driver (1/4-in drive)	IFM tray 3, MF14G
Drop Proof Tether Adapter	ISS Pregather CTB
ISS EVA Ratchet (with palm wheel)	ISS Pregather CTB (was MPLM)
Plug Installation Tool (PIT)	MF43K
EVA Marker	MF43K
Feeler gauge (0.010/0.020)	MF43K
Feeler gauge (0.030/0.035)	MF43K
ULD (optional)	ML60M
Latex gloves	WCS

4. Install drop-proof tether adapter, 3/8- to 1/4-in adapter and 5/32-inch ball tip hex driver onto PGT
5. Set PGT – not MTR, then set PGT MTL to 2.5
6. √PGT power – OFF, install PGT Battery
7. Perform PGT calibration (power-on, ratchet collar – not MTR, speed collar – CAL, pull trigger)
8. Configure PGT to **A1 (2.5 ft-lb), CW2 (30 RPM), 2.5**
9. Don latex gloves (required for use with plug and patch)

CAUTION
Patch is 121 DTO arc jet sample. Avoid inadvertent tool contact with patch and handle carefully. Coating on plug patch and bolt head is sensitive to scratching/damage. Metallic parts are brittle

10. Retrieve IVA Plug Demo Assembly (MD Floor port 2)
11. If reqd, touch up soapstone markings on plug assembly and demo panel

PLUG INITIAL INSTALLATION

12. Install PIT onto plug with handhold set for left-handed handling with respect to 12 o'clock marking (see RCC PLUG REF DATA)
13. Insert plug into hole in demo panel, align clocking marks on patch with demo panel alignment marks (t-bar orientation is 3-9 o'clock)

WARNING
T-bar is a pinch hazard

RCC PLUG REPAIR DEMO (IVA) (Cont)

14. Drive t-bar until clearance is ~ 0.5 inches, with these reminders:
    a. Keep driver perpendicular to plug to avoid rounding out Allen interface on plug bolt head and avoid scratching bolt head during driver installation/removal
    b. Push in for first few turns to ensure t-bar clears panel opening while pivoting
    c. Expect bolt locking feature to ramp up torque at ~70 turns (6-12 in-lb)
    d. After ~ 70 turns, lightly move plug in and out to assess t-bar clearance, then drive 5-10 turn increments until ~0.5 inch clearance is achieved (expect ~ 80 turns total)
    e. Record total PGT turn count _____
15. Remove palm wheel from ISS EVA Ratchet
16. Transfer 5/32-inch driver from PGT to palm wheel

NOTE

Initial standoff at 3 and 9 o'clock between patch and Demo panel when T-bar driven to "light contact" (prior to preloading patch) is ~ 0.10 inch

17. Fasten t-bar with palm wheel just until patch is in light contact with demo panel (plug seats but is not applying significant load), record additional turns _____
18. √Patch properly aligned with demo panel alignment marks
19. Fasten t-bar one quarter turn or as required until patch does not easily slide out of alignment, record total turn count so far _____

PLUG FINAL TORQUE

20. If PIT interferes with gap check or visibility at any time, remove PIT by restraining patch with thumb at 9 o'clock, and removing PIT using peel motion only
21. Verify no plug rotational or translational shift, per alignment marks

* If plug shifted, reinstall PIT, realign plug, fasten t-bar 1/4 turn, remove PIT *

CAUTION

Proper feeler gauge use is required to ensure plug is not damaged:
- Lightly tap gauge against plug edge (do not force)
- Hold gauge tip flat against demo panel (prevents bad reading)
- If gauge inserts, do not continue to push gauge in and do not slide gauge under patch

22. Perform initial gap check with 0.020 feeler gauge. Start at hard contact locations 12 and 6 o'clock. Measure around patch to identify tightest locations that fail 0.020 gap and lightly mark (on patch) the locations (expect 4, mark them the same way each iteration)

RCC PLUG REPAIR DEMO (IVA) (Cont)

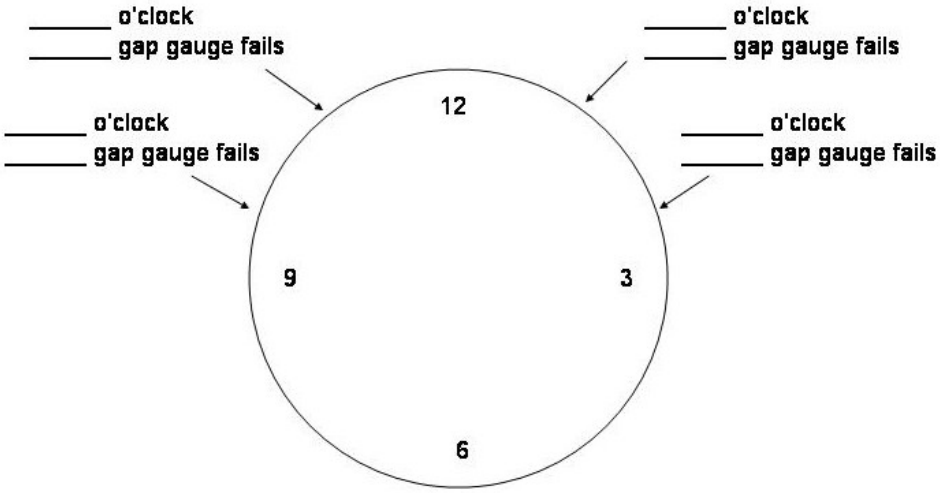
NOTE

Drive bolt will be iteratively tightened. Nominal stop criteria is when all four gap measurements are no longer changing. Stop tightening procedure early if any gap measurement increases, if all gap measurements pass the 0.020 gauge check, or if 90 turns is reached. (Plug demo might pass all gap measurements when complete.)

23. Perform steps 24-25 until above stop criteria is met
24. Fasten t-bar ¼ turn with palm wheel, continue to track total turns applied
25. Verify gap continuing to close by repeating 0.020 feeler gauge measurements and markings

When stop criteria met:

26. Perform final gap assessment with all feeler gauges, recording max gaps at gauge-failing positions (photograph final marks as time permits)



27. Record final total turn count _____

PLUG REMOVAL

When demo complete:

28. Install PIT
29. Disengage plug 3 turns manually with palm wheel
30. Transfer 5/32-inch driver to PGT
31. Recalibrate PGT if reqd (power-on, ratchet collar – not MTR, speed collar – CAL, pull trigger)
32. Configure PGT to **A1 (2.5 ft-lb), CCW2 (30 RPM), 2.5**

CAUTION

Do not allow T-bar to fully pivot using PGT. Guide pins could shear off if T-bar is forced past retracted position

33. Retract t-bar until it begins to pivot (~72 turns)
34. Transfer 5/32-inch driver from PGT to palm wheel
35. Manually retract t-bar
36. Remove plug assembly, stow MD Floor port 2 (hold patch when removing PIT)

RCC PLUG REPAIR DEMO (IVA) (CONT)

37. Remove latex gloves, discard
38. PGT PWR – OFF
39. Set PGT not – MTR, then reset PGT MTL to 30.5
40. Remove sockets from PGT, stow PGT and RET w/PIP pin in STS airlock per EVA 3 TOOL CONFIG
41. Stow remaining tools

MSG 087 - FD08 WATER ACTIVITY SUMMARY

FD08 Water Activities Summary:

The following will be dumped sequentially through the waste dump line: the waste tank, two ISS Condensate CWCs (S/N 1027, 1026) and the first Shuttle Condensate CWC (S/N 6008). The procedure flow will be to start in the SUPPLY/WASTE WATER DUMP (ORB, OPS, ECLS) and during the post waste dump nozzle bakeout to 250 degF, set up for the CWC OVERBOARD DUMP (ORB OPS, ECLS).

Additionally there will be two PWR fills and one SUPPLY H2O CWC fill.

FD08 Water Dump Details:

Prior to the waste water dump scheduled at 6/15:25, pregather the following:

ISS Condensate CWC S/N 1027 (temp stowed after last waste dump)
ISS Condensate CWC S/N 1026 from ISS NOD1P2
Shuttle Condensate CWC S/N 6008 (temp stowed on FD6 after Shuttle Condensate Collection - Changeout)

Waste Water Dump (WWD) Filter from the Shuttle BOB (MF14H)

CWC (Yellow-Yellow 20 ft) hose from Shuttle CHCK.

At MET 6/15:25 MET, perform a waste water dump using SUPPLY/WASTE WATER DUMP (ORB OPS, ECLS), p. 5-2 Steps E, G and I #1 and I #2. Dump the waste tank to 5%, dump duration will be approx. 15 minutes. MCC will TMBU all FDA limits.

After Step I #2 of SUPPLY/WASTE WATER DUMP (ORB OPS, ECLS) complete, exit that procedure and begin dumping ISS Condensate CWC S/N 1027 starting in Step A DUMP PREP of CWC OVERBOARD DUMP (ORB OPS, ECLS), p. 5-32. Do not perform steps B, C and H. Sequentially dump ISS Condensate CWC S/N 1026 and then Shuttle Condensate CWC S/N 6008. MCC will TMBU all FDA.

CWC S/N 1027 dump duration will be approx. 25 minutes, CWC S/N 1026 dump duration will be approx. 53 minutes and CWC S/N 6008 dump duration will be approx. 47 minutes.

Post dump, the CWC stowage locations will be:

ISS Condensate CWC S/N 1027 to ISS NOD1P2
ISS Condensate CWC S/N 1026 to ISS NOD1P2
Shuttle Condensate CWC S/N 6008 to either Middeck MF43E or MF43G

MSG 087 - FD08 WATER ACTIVITY SUMMARY

For the H2O fills on CDR:

1. MET 6/18:35 – Fill one PWR that was temp-stowed after being vented on FD06; verify that it has a S/N from among the following: 1005, 1011, 1012. Use PWR FILL (ORB OPS, ECLS), p. 5–43. Note that Steps 1 and 14 of this procedure are not req'd. Temp stow the PWR for transfer to ISS following the subsequent water fills later today.

2. MET 6/21:00 – Fill another PWR that was temp-stowed after being vented on FD06; verify that it has a S/N from among the following: 1005, 1011, 1012. Use PWR FILL (ORB OPS, ECLS), p. 5–43. Again, Steps 1 and 14 of this procedure are not req'd.

   After both PWR fills are complete, report their S/Ns to MCC and temp stow them for transfer to ISS later today.

3. MET 6/21:30 –There is one CWC fill scheduled for today. Use a CWC located in the Middeck from among those with the following S/Ns: 1052, 1055, 1057, 1058, 1063. Perform this fill using CWC FILL in SHUTTLE/ISS H2O CONTAINER FILL (ORB OPS, ECLS), p. 5–26, and expect the fill to last about 56 minutes. The additives are Silver biocide and minerals, and a sample is not required.

   Following the fill, squeeze the CWC and inspect the outer canvas cover and all fittings for cracks and leaks; report the bag's condition to MCC along with its S/N and Barcode.

   Finally, transfer both filled PWRs and the filled CWC to ISS: stow both PWRs in the ISS A/L Equipment Lock Floor Bin, and report the stowage location of the CWC to MCC.

MSG 088 - EVA 3 HACKSAW PRACTICE SETUP

This procedure sets up a practice station for the Hacksaw Assembly tool. While the feel of the paper is not exactly like that of the gap filler, it is felt that this is overall a reasonable approximation, as this procedure is intended more as practice using the saw rather than actual feel of cutting gap filler. Based on testing with both gap filler and paper, it is felt that the paper requires slightly more force and generates less debris.

Tools:

- Printer Paper (~6 sheets)
- Flight Data File covers (qty. 2)
- Gray Tape
- Hacksaw Assembly tool
- DC Vac
- Goggles
- Surgical Mask

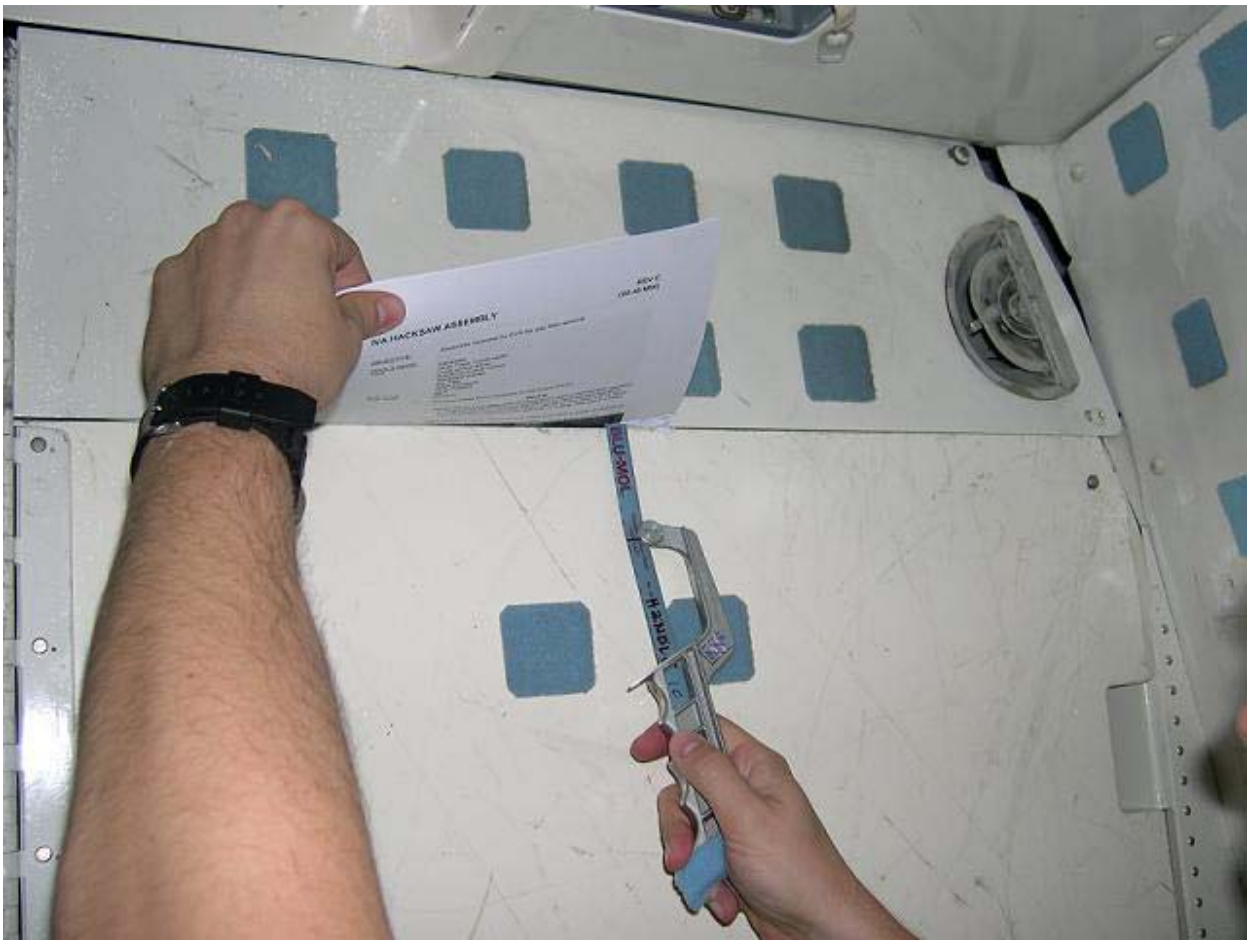
Location:

- WCS Door

1. Gray tape Flight Data File covers on the outside of the WCS door above and below seam in order to protect paint and velcro.

NOTE:
FDF covers not shown in picture

2. With WCS door slightly open, place ~6 sheets of printer paper between door and upper wall as shown in attached image and close the door.
3. Don goggles and surgical mask.
4. Move DC Vac to work site in order to capture debris.
5. Turn on DC Vac.
6. Practice sawing paper, keeping saw blade flush with FDF covers.


EVA HACKSAW ASSEMBLY

Here are the summary results of the FD7 MMT.

The major discussion and decision point from the MMT today was with regard to performing the EVA task to remove the 2 protruding gap fillers. The MMT decided that the prudent course of action was to add this task to EVA 3 to remove the uncertainty and potential concerns for flying entry with the gap fillers in place. As a result we are sending along more details of the task and timeline, and the overall plan for EVA 3 with this task inserted.

The MMT decision resulted after careful deliberation and extensive discussion on the potential thermal and structural effects of leaving the gap fillers in place and experiencing early boundary layer transition (BLT), as compared to the relative risk aspects of this particular EVA task. The following outlines some of those particulars, and of course we're also sending along the presentation material for your consideration.

The aero/thermal team outlined their approach to predicting the point at which early transition could occur, and they then discussed the resulting potential thermal implications for both the RCC and TPS tile. As you know there are many challenges in this area, not the least of which is that the wind tunnel and CFD data bases do not cover this Mach regime, and of course the only flight test data we have is that for Shuttle entry, since no other winged vehicles have flown in this regime. We have had 2 documented cases of early BLT at ~ M 18, STS-28 and STS-73. We have had several cases of early transition and ABLT at lower Mach numbers, the majority of them in the M 12-15 region. For reference, transition normally occurs in the M 8-12 region. As a result, the team used this limited flight data for the M 18 early BLT's to extrapolate on the currently accepted and certified model for BLT. The extrapolation was necessary in order to consider the effects of having early BLT with our flight conditions, primarily because these gap fillers are further forward relative to our data base, and among other things the BL is thinner in this area over these forward nose tiles. The end item answer is that because of the further forward position and the amount of protrusion that we have, approximately 1", the resulting best estimate for early BLT is ~ M21.5 (+/- 2.5M).

The team then evaluated the potential effects of an early BLT in this Mach regime, and presented the results for both the RCC and the TPS tile area. It was noted that as it relates to the RCC, we have no documented flight evidence or reason to believe that we have ever had early transition that affected the RCC. Said differently, we have no evidence that we have ever had turbulent flow wash onto the RCC in these regions of higher heating. However, given an early BLT at M 21.5 and the resulting flow due to these gap fillers being off-centerline, the analyses show that we could have turbulent flow wash onto the RCC. It was noted that these analyses were overall best estimate (conservative in some aspects and best estimate in other aspects). The magnitude of the resultant heating could be on the order of the heating rates that we expect on a TAL for example, where we go to the single use

RCC limits of ~ 3250 deg F. This is compared to the nominal EOM multi-flight reuse limits that we design to of ~ 2950 deg F. If the early BLT occurred at the high end of the uncertainty at ~ M 24 the heating rate could be even higher than our TAL limits by ~ 100 deg F.

For the tile areas, the analyses showed that this thermal profile could result in negative margins on the mid-body and aft fuselage structures from the normal 1.4 FS. The results ranged from slightly negative margins to as much as a 30% decrease in the FS (0.98 FS) depending on the exact tile locations.

As a note, the aero and flight control communities also reviewed these conditions and determined that there would be no concerns. As you'll recall the WRAP DAP was designed to handle early transition and ABLT, so these satisfactory results were expected. As such, the MMT opted to not review those specific details, although the technical community did the necessary rigor for completeness.

The team acknowledged that there is high uncertainty in the analyses for determining just how early BLT could occur, as well as for determining the resulting potential thermal implications for the RCC and tile. It is possible that we've flown with these conditions before, however we do not have data to show that we have and therefore we cannot prove that it would be a lower risk than the EVA task. As such, given the relative risk trade between the potential for these heating conditions as compared to the EVA task to remove the gap fillers, the MMT determined that the EVA was the prudent approach.

As for the proposed EVA 3 task, the first and preferred option is to remove the gap fillers by pulling them out with the gloved fingers, or the forceps if required. The downmode will be to cut them off to the lowest level feasible, with the hacksaw or scissors. If they are left in place the desire is to get them to a height of no more than ~ 0.4 ". The general plan would be to pre-position ESP-2 on FD8, and then access the area from the starboard side with an APFR on the SSRMS after completing the ESP-2 installation task. The current estimates are for a 7:15 duration EVA, with 1:15 dedicated to the gap filler task. We are sending the details of this task as well as the overall EVA 3 plan for your consideration and look forward to your comments/questions.

Turbulent Heating on WLE for STS-114

Don Curry
Alvaro Rodriguez
NASA Johnson Space Center

Mark Fields
The Boeing Company

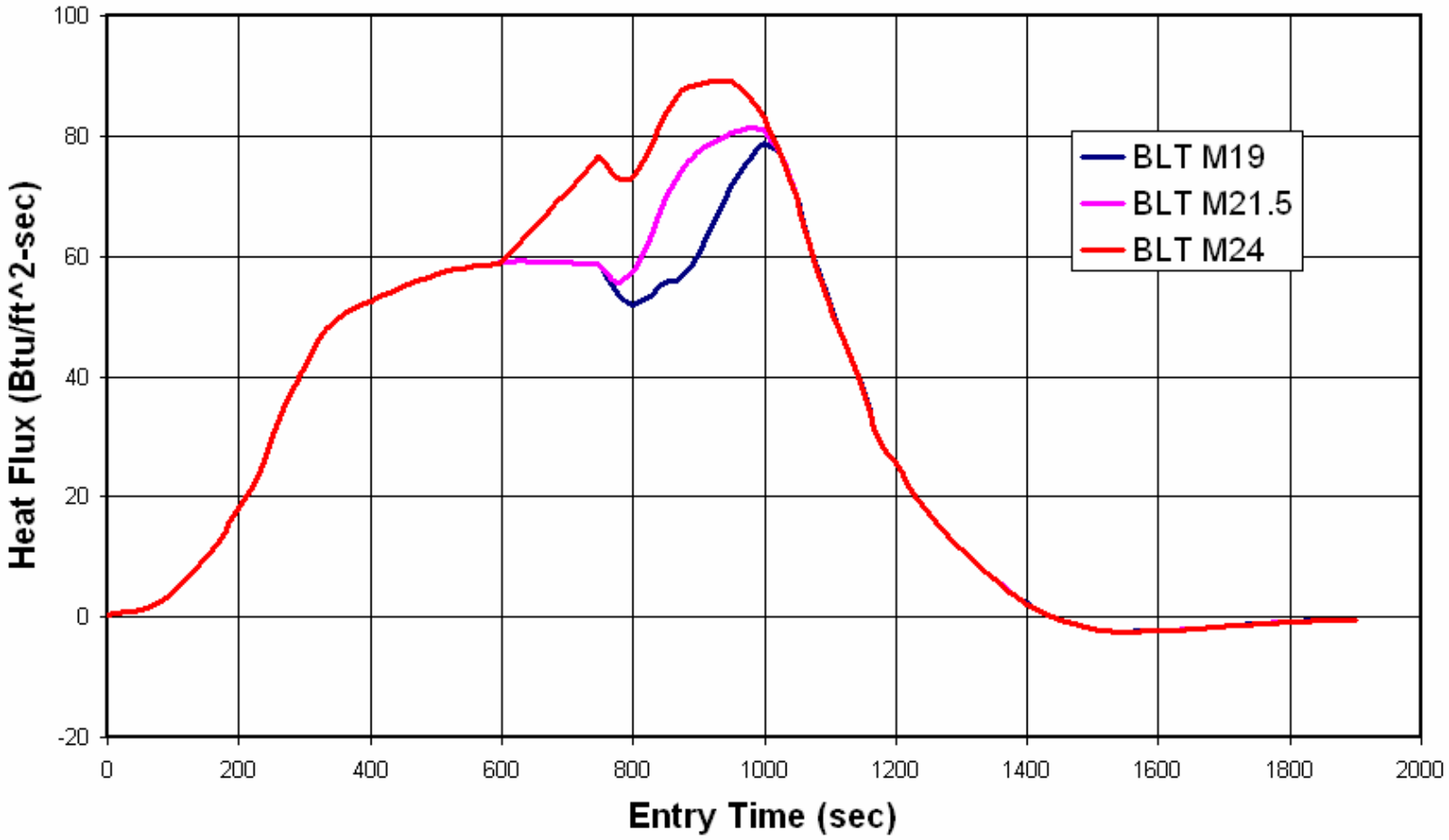
August 1, 2005

Turbulence Heating Effects on WLE

- **Exposed gap seals on forward Orbiter lower surface will trip boundary layer earlier in entry trajectory**
- **Turbulent BL effects will increase heating on WLE**
  - Panel 9 and 16 analyzed to determine effects
    - Laminar heating profile for STS-114 EOM used
    - Turbulent heating “bump” factors as a function of time used
  - Boundary layer transitions modeled at different Mach numbers
    - Mach 21.5 BLT at 765 seconds
    - Mach 24.0 BLT at 605 seconds
    - Mach 19.0 BLT at 885 seconds

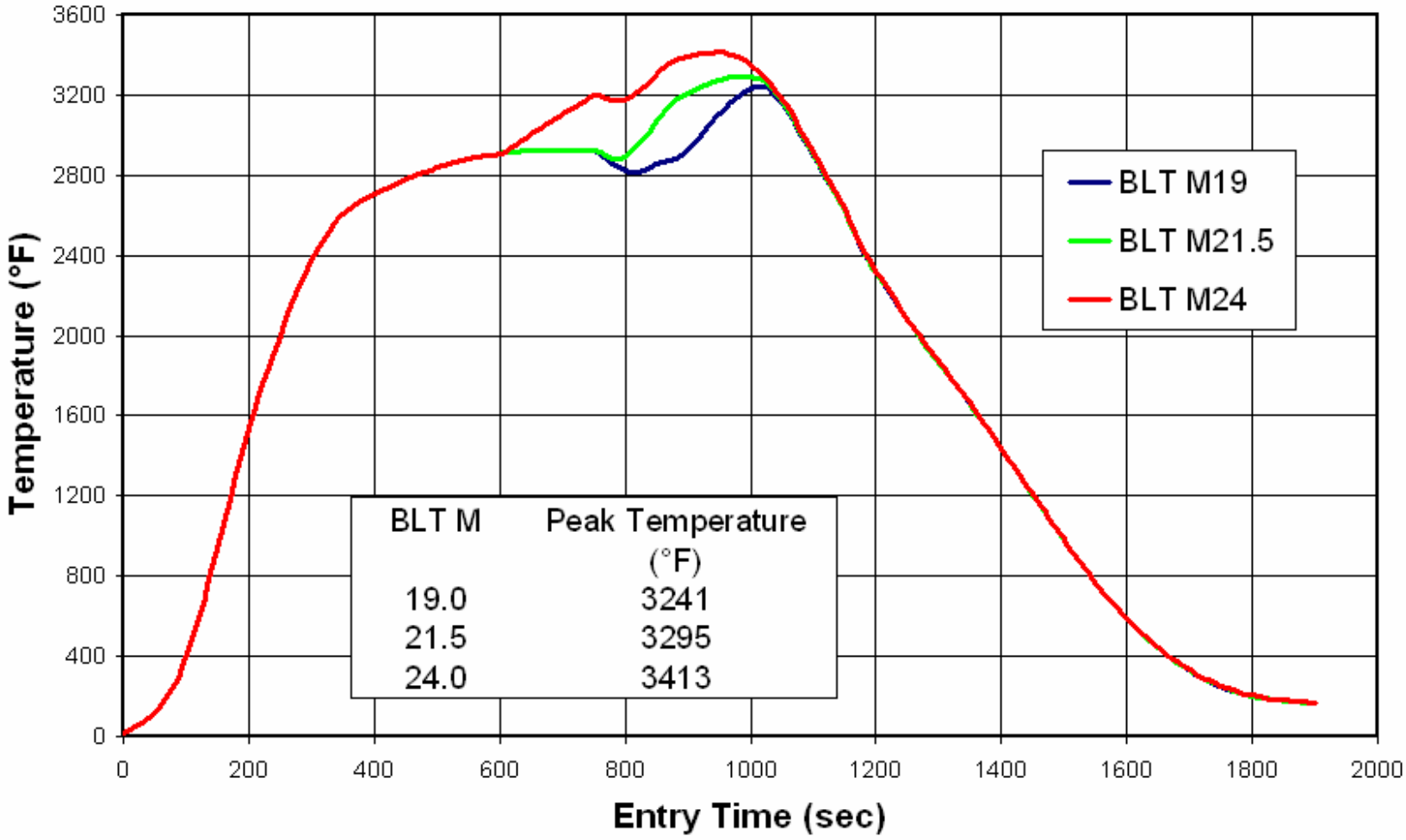
WLE Heat Flux Results

Panel 9 Zone 3 Maximum Heat Flux Profile for Turbulent Heating



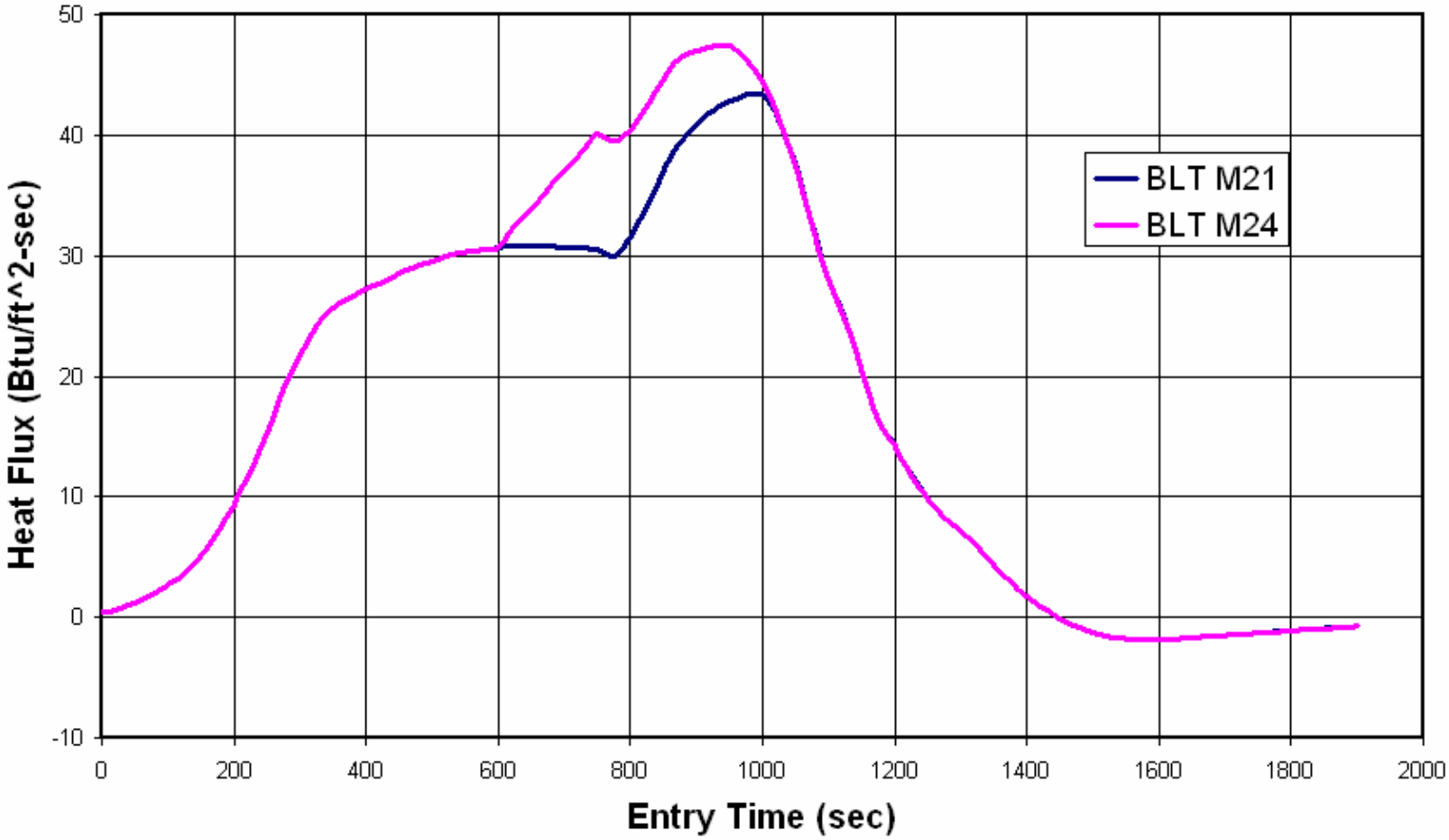
WLE Temperature Results

Panel 9 Zone 3 Maximum Temperature Profile for Turbulent Heating



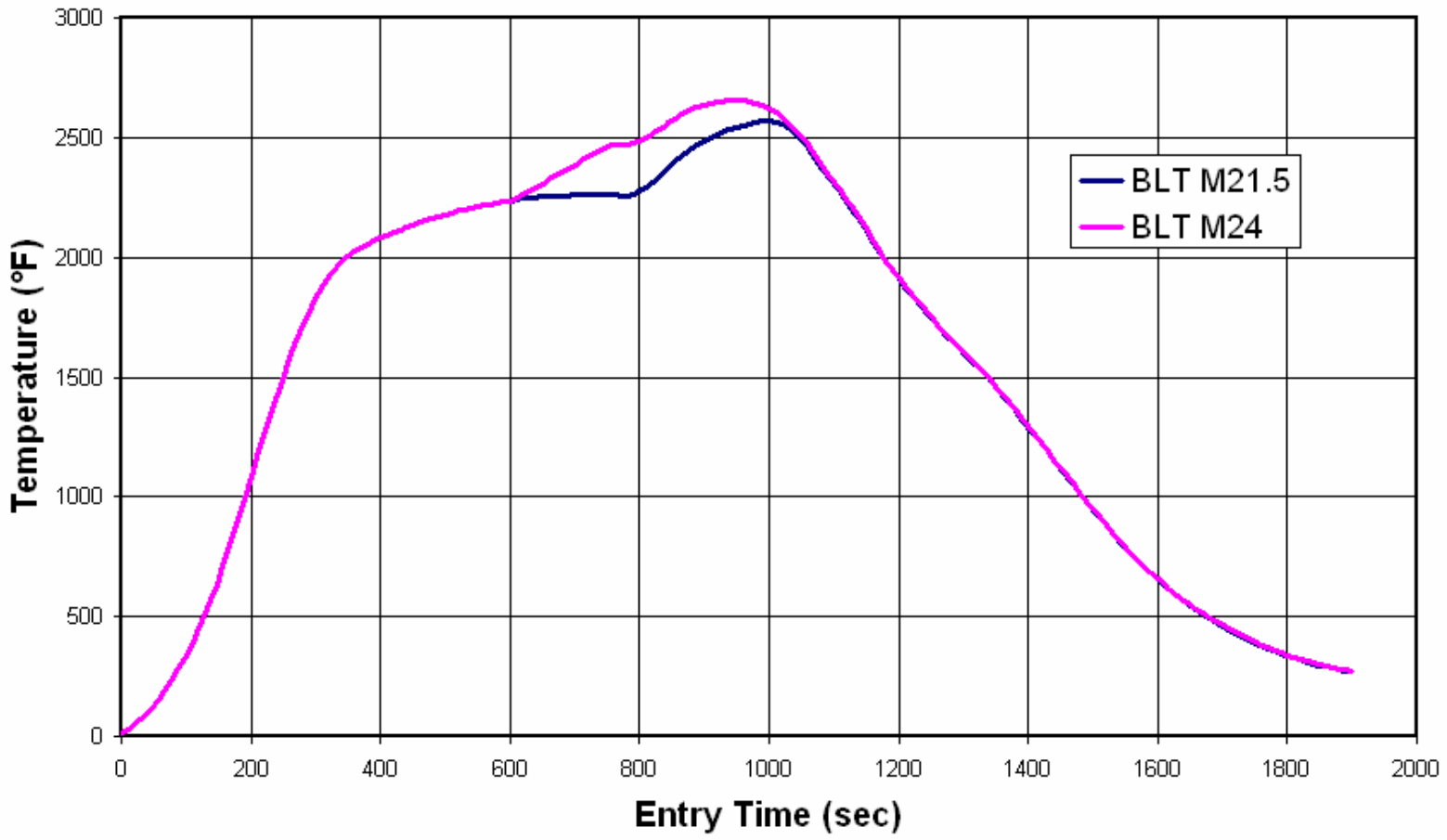
WLE Heat Flux Results

Panel 16 Zone 3 Maximum Heat Flux Profile for Turbulent Heating



WLE Temperature Results

Panel 16 Zone 3 Maximum Temperature Profile for Turbulent Heating

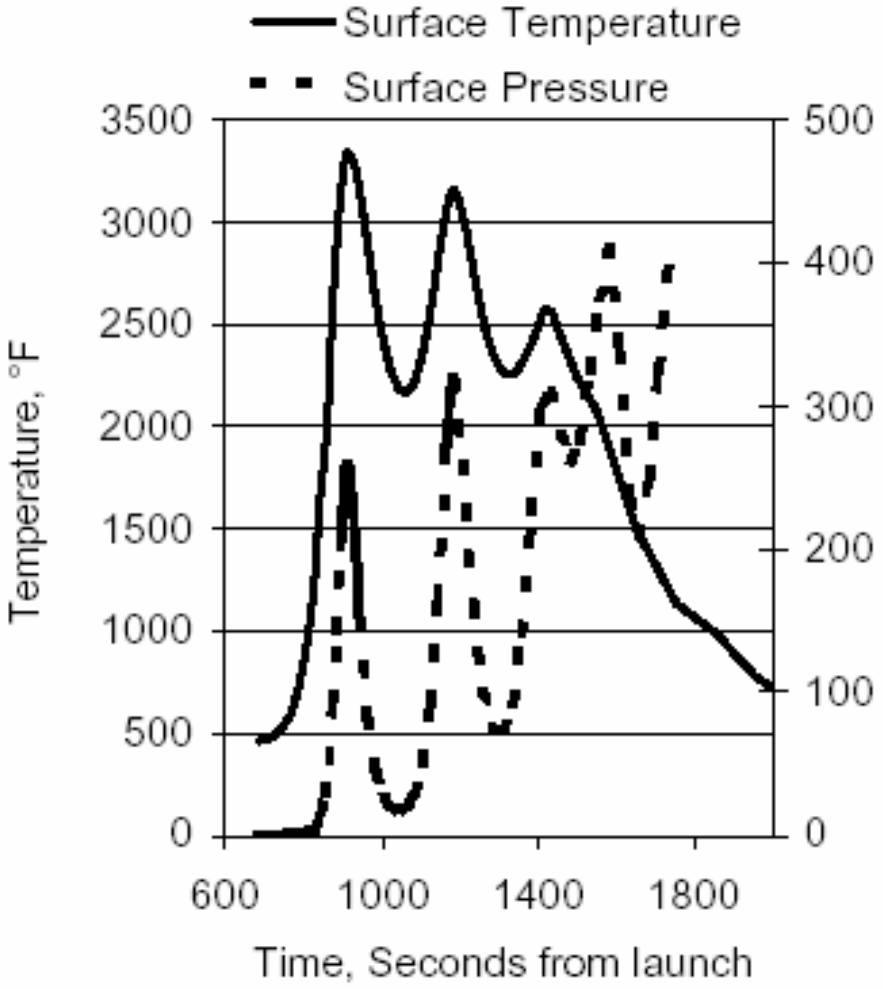


Silicon Carbide Ablation Panel 9

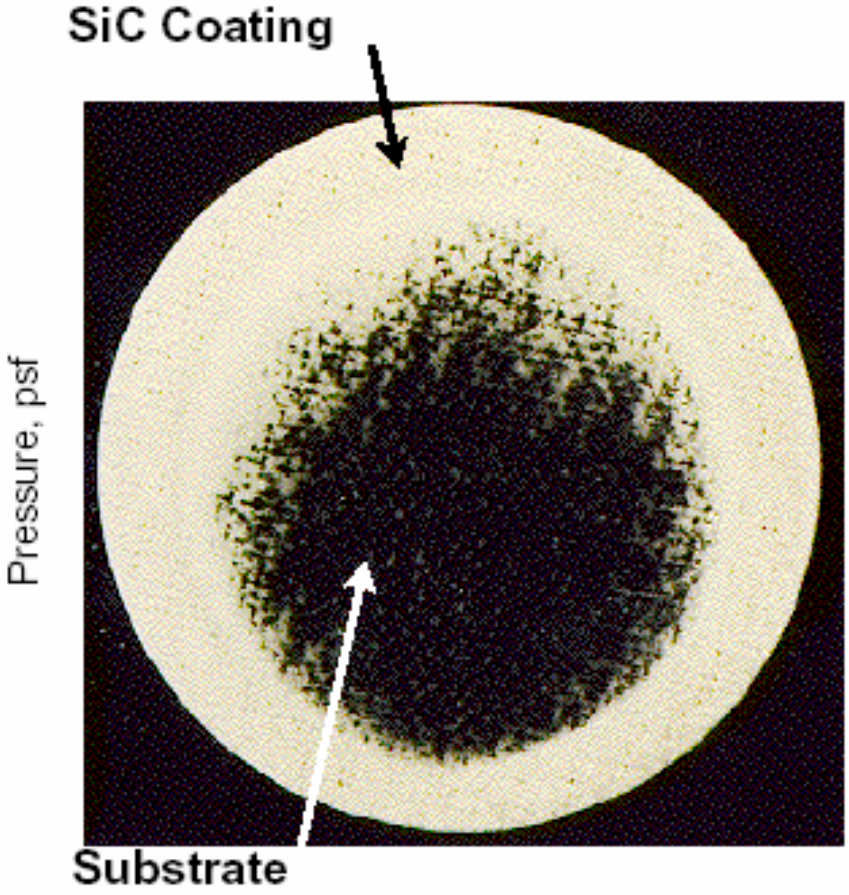
Zone	BLT @ Mach 19.0		BLT @ Mach 21.5		BLT @ Mach 24.0	
	SiC BT Time	SiC Recession	SiC BT Time	SiC Recession	SiC BT Time	SiC Recession
1	None	0.00005	None	0.0002	None	0.0009
2	None	0.0002	None	0.0005	None	0.0023
3	None	0.0053	None	0.0152	**910**	**0.0200**
4	None	0.0002	None	0.0005	None	0.0023

- **Panel 9 Zone 3 for early BL transition at Mach 24 is only zone predicted to burn thru silicon carbide and expose the underlying carbon substrate in 910 seconds**
  - Subsequent carbon substrate burn through is predicted
- **These are nominal predictions and do not include any trajectory dispersions**
  - The trajectory that was used to define heating was developed with mean wind and atmosphere that creates a potential increase in temperature of 150F or a potential decrease of 50F

SiC Burn Thru Arc Jet Test at 3250F



RCC Panel 9 Entry Surface Environment Contingency Abort



Over Temperature Post Arc Jet Test

- **Arc jet test data was used to establish the SODB limits for RCC as stated in Table 3.4.1.3-1**
  - 3,000F is the multi-mission temperature limit
  - 3,220F is the single-mission temperature limit
- **The conditions identified from these analyses violate this 3,220F limit for zone 3 (node 7279)**
  - Mach 19.0 BLT = 3,241F
  - Mach 21.5 BLT = 3,295F
  - Mach 24.0 BLT = 3,413F
- **The potential temperature increases on account of trajectory dispersions creates increased risk**
- **LESS PRT recommends removal of gap fillers to eliminate this threat to the RCC WLE Panel Assemblies**

Back Up

Tabular Results

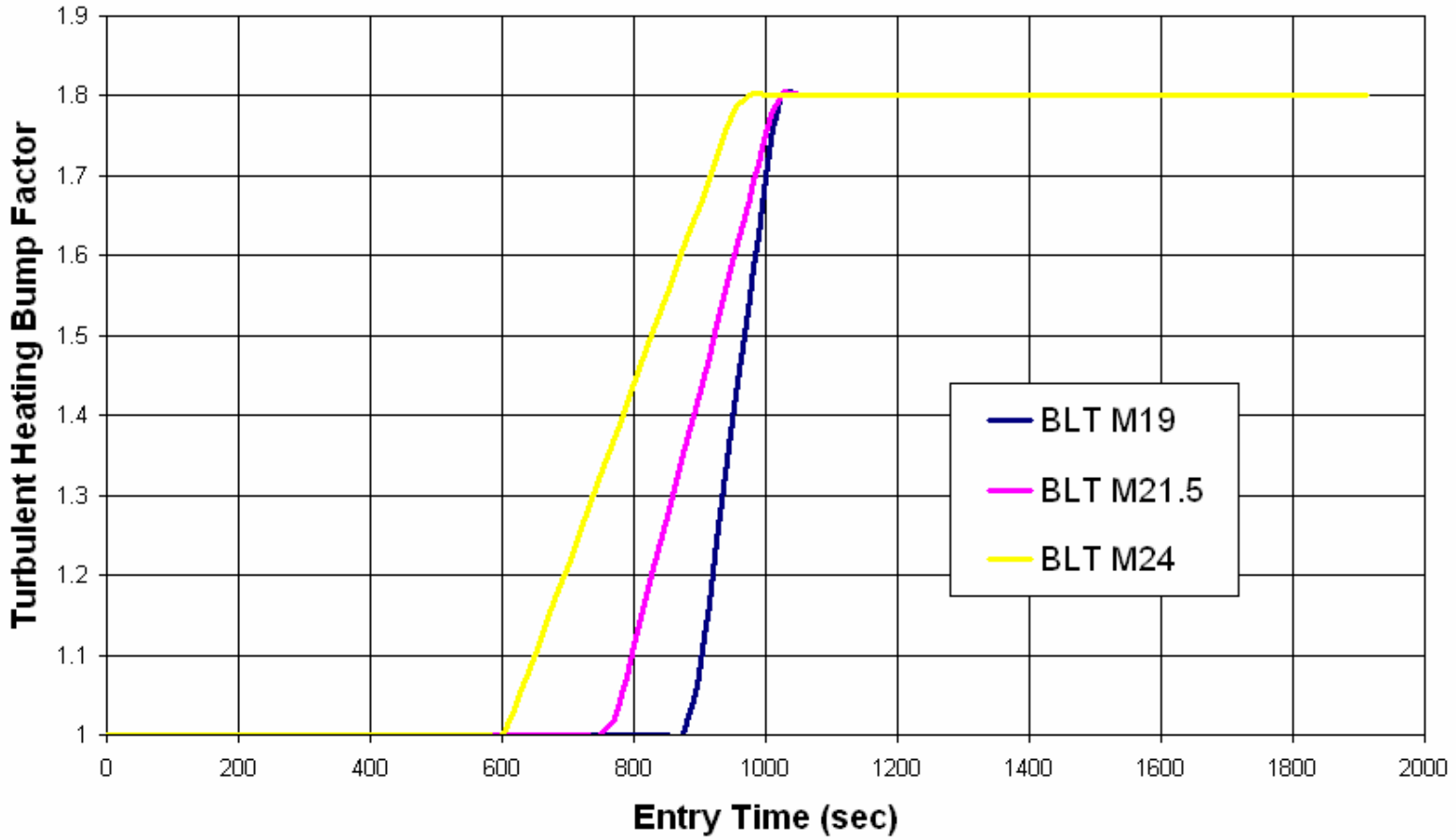
Presenter Don Curry

- **Individual Zone Maximum Temperatures**
- **Zone 3 is stagnation zone**
- **3 BLT Times**
  - Mach 21.5
  - Mach 24.0
  - Mach 19.0
- **Panel 16 not run for Mach 19 case**

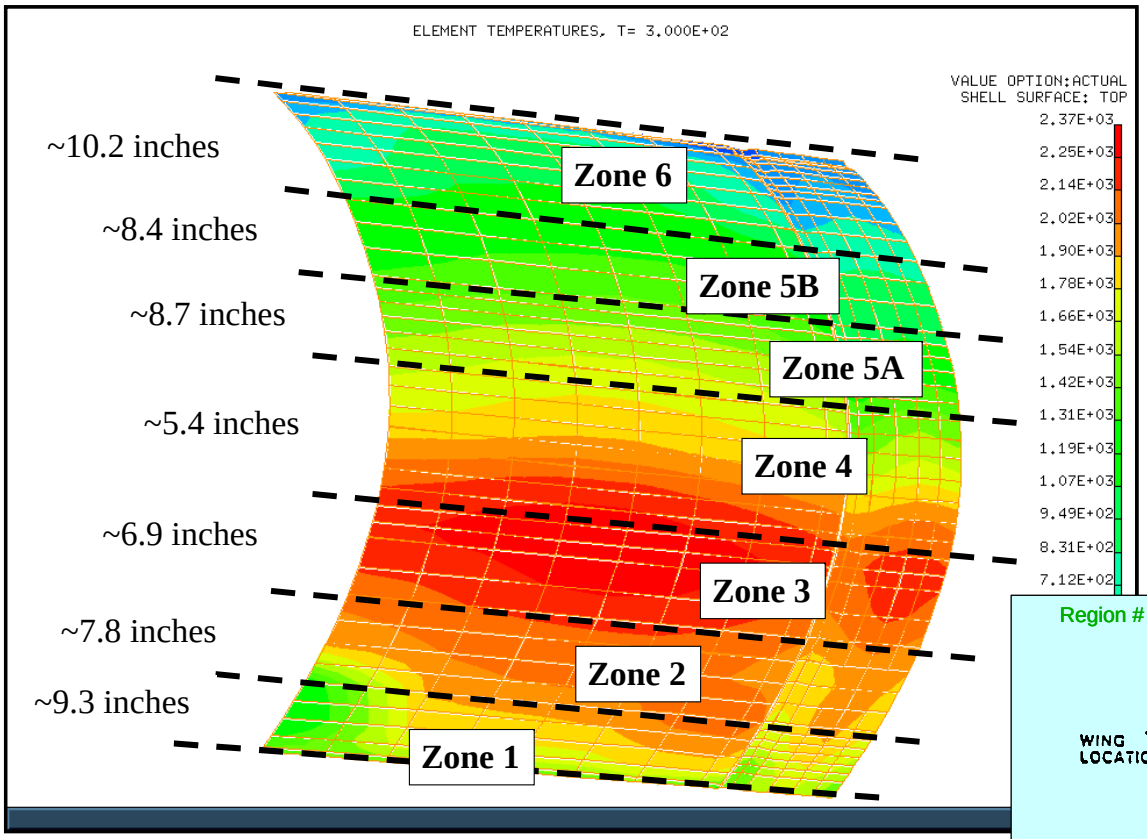
	Panel 9		Panel 16	
	Node	Temp	Node	Temp
Mach 21.5				
6	7299	2048.7	847	2266.1
5b	7258	2184.9	467	1770.3
5a	7288	2483.7	309	2098.9
4	7282	3043.1	447	2535.2
3	7279	3295.3	731	2570.1
2	7161	3047.1	905	2396.1
1	7160	2977.8	843	2322.0
Mach 24				
6	7299	2115.6	847	2349.0
5b	7258	2254.4	467	1824.9
5a	7288	2564.7	309	2164.9
4	7282	3142.7	447	2617.9
3	7279	3413.3	731	2656.7
2	7161	3149.9	905	2480.1
1	7160	3082.6	843	2406.2
Mach 19				
6	7299	2003.9	N/A	N/A
5b	7258	2139.5	N/A	N/A
5a	7288	2436.1	N/A	N/A
4	7282	2990.1	N/A	N/A
3	7279	3241.4	N/A	N/A
2	7161	2998.0	N/A	N/A
1	7160	2919.0	N/A	N/A

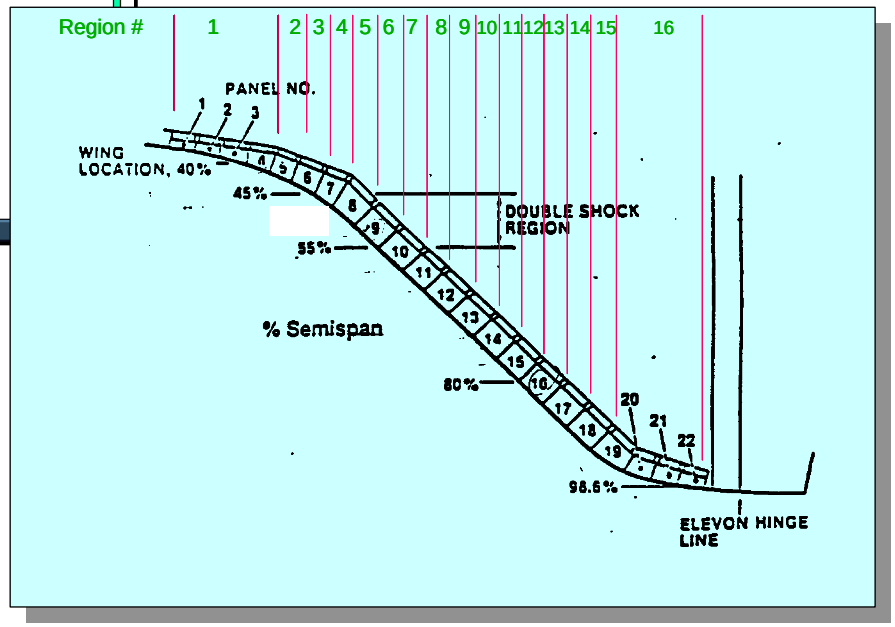
Turbulent Heating Factors

Turbulent Heating Bump Factors for Different Boundary Layer Transition Times



LESS Zones and Regions





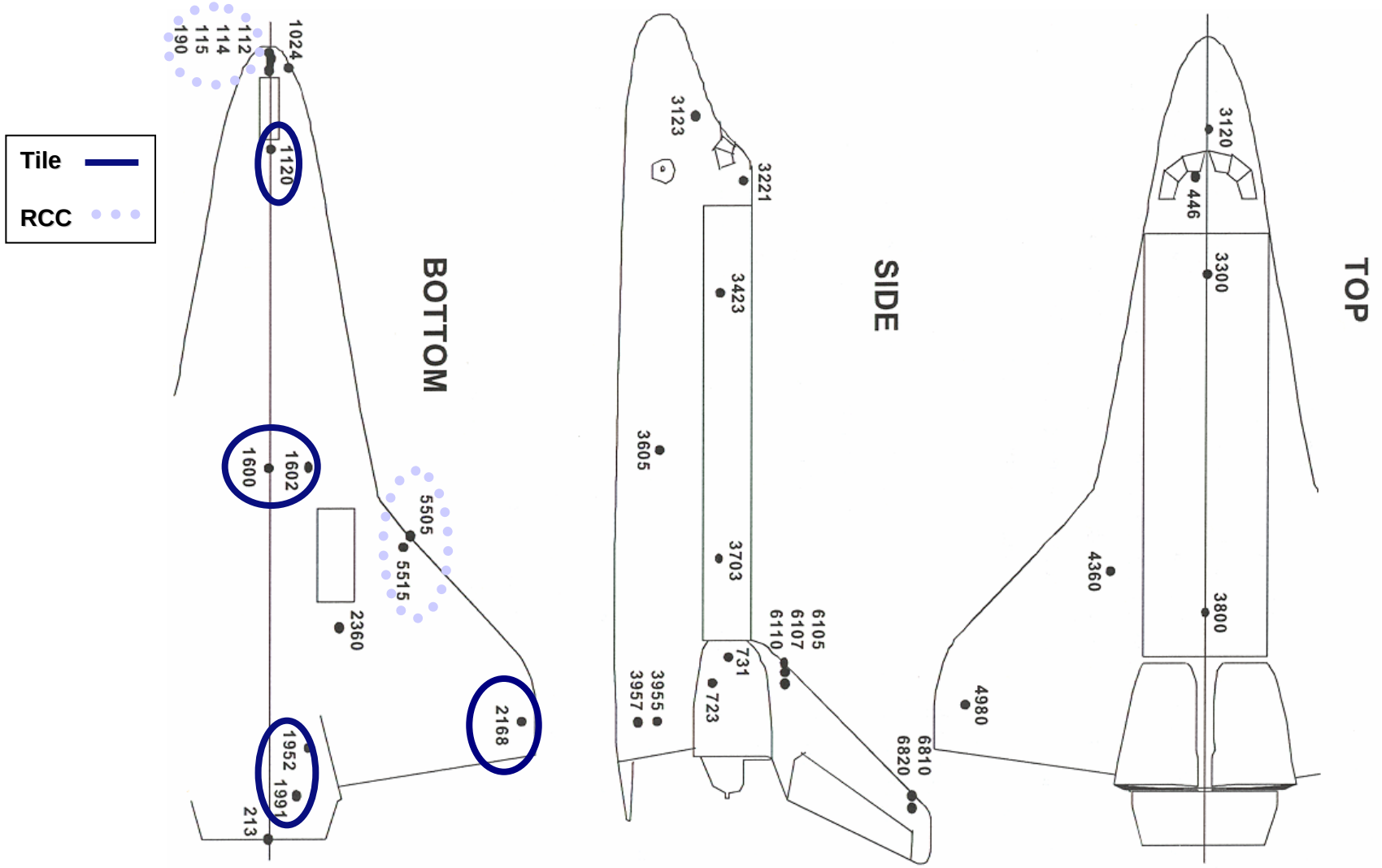
TPS Protruding Gap Filler Assessment Flight Day 7 Summary

Dan Bell
Damage Assessment Team/ TPS PRT

Evaluation of Roughness Beyond Keq=.250 on Orbiter Bottom Skin Structure

- **This assessment represents an extrapolation of tools beyond flight or test experience**
- **Protruding gap filler on STS-114 is predicted to cause very early transition to turbulent heating, raising temperatures on the bottom of the Orbiter**
  - **Aeroheating has identified potential transition times earlier than Mach 18.9 (Keq=.250) which would cause increased temperatures and decreased structural margins/FoS**
- **The effect on structural margins evaluated with**
  - **No TPS damage is present**
  - **Local gradients from partial transition not included**
- **Internal loads are available for ISS Heavy Fwd trajectory with nominal (.130/.146) and high (.250) roughness with bottom sun Entry Interface temperatures**
  - **Can be compared to PE certification thermal cases**
  - **Above thermal loads have been combined with certification (2.5g/9.6fps) mechanical loads and reduced (2.0g/6fps) mechanical loads**
- **Combined loads were evaluated using the stress assessor tool (DTT) with no local thermal gradient (no TPS damage)**
  - **Skin panels on bottom surface excepting wing skin stringer and NLGD**

TSEP: Body Point Locations Assessed



Evaluation of Roughness Beyond Keq=.250 on Orbiter Bottom Skin Structure

- **New heating cases are beyond certification and internal loads databases; heat loads are used to estimate thermal stress increase**
  - **This method is used to verify descent trajectory designs are within certification (SODB Volume V – TSEP program)**
    - **Heat load is a good indicator of thermal stress when "shape" of heat rate curve is similar**
    - **Use of this method in this case has increased uncertainty because:**
      - TSEP always evaluates heat loads within certification (interpolation); these early transitions are an extrapolation of internal loads/stress database
      - Earlier transition violates the similar curve shape assumption to some extent
- **Structural margins are available for skin at nominal and Keq=.250 cases**
  - **MS partials are calculated for this change in Keq (and heat load)**
  - **MS partial for earlier transitions are a ratio of increase in heat load**

Evaluation of Roughness Beyond Keq=.250 on Orbiter Bottom Skin Structure

BPT	Max RE Heat Load (Btu/ft^2)				Delta from Nominal			
BPT	F130/W146 K=.13=>Mac=12.4 K=.146=>Mac=14.5	K=0.25" Mc=18.9	Mac=21.5	Mac=24.0	K=0.25" Mc=18.9	Mac=21.5	Mac=24.0	
213	10009	10020	****	****	100%	100%	100%	Body Flap
1120	10095	11373	12086	12799	113%	120%	127%	Aft of NLGD
1600	6545	8211	9035	9972	125%	138%	152%	Mid Fuselage
1602	7157	8990	9911	10945	126%	138%	153%	Mid Fuse (outbd)
1952	6802	8246	8951	9806	121%	132%	144%	Aft Fuse (outbd)
1991	3654	5299	6119	7155	145%	167%	196%	Aft Fuse trailing edge
2168	11290	11265	11742	12975	100%	104%	115%	Outbd Elevon
2360	7370	8958	10214	11680	122%	139%	158%	Wing (Aft of MLGD)

MS Partial calculated from these two cases (baseline – B/L)

B/L

1.5 x B/L

2.1 x B/L

- Effect of roughness is lowest at the fwd end of vehicle and greatest at the aft
  - Elevons and body flap are primarily driven by their position, not by fuselage/wing roughness
- Heat load (and therefore structural MS partial) is 50% higher for Mach 21.5 and slightly more than 110% higher for Mach 24 compared to baseline case
  - Wing is exception with 80% and 170% increase respectively

Evaluation of Roughness Beyond Keq=.250 on Orbiter Bottom Skin Structure

- **ISS Heavy Fwd with 0.250 roughness is nominally worse than PE certification, but maintains positive MS when combined with 2.0g/6fps mechanicals**
  - **ISS trajectory gives modest relief which is (more than) offset by higher roughness**
  - **Mid fuselage is most sensitive and have -.05 margin for cert mechanical and +.02 margin with 2.0g/6pfs mechanicals**
- **Earlier transitions decrease structural margins (flight specific thermals with reduced mechanical)**
  - **For Mach 21.5 transition, aft fuselage was identified to have two panels with MS=-0.05 and -0.15 (FoS =1.35 & 1.19)**
  - **For Mach 24 transition, margin reductions in the aft fueslage panels were reduced to MS=-0.15 (FoS=1.19) and MS=-0.03 (FoS)=0.98**

OV-103 STS-114 EOM 1-D Thermal Results

OV-103 STS-114 EOM 1-D Thermal Results

Location	BP (T_{ini})	Temperature (°F)							
		Structure (N 22)				RTV/SIP (N 20)			
		1	2	3	4	1	2	3	4
Body Flap/Max	213 (131)	163	163	150	155	175	175	160	166
TAEM		133	133	132	132	137	137	135	136
TD		121	121	119	120	146	146	140	142
Fwd Fus/Max	1120 (106)	286	291	298	306	442	449	460	470
TAEM		268	273	280	287	440	448	459	470
TD		278	282	289	295	395	400	409	416
Mid Fus/Max	1600 (90)	278	289	300	313	462	483	507	530
TAEM		266	277	288	302	443	457	471	485
TD		267	276	286	297	341	350	361	371
Mid Fus/Max	1602 (92)	305	316	329	344	573	604	642	674
TAEM		299	310	323	338	466	477	488	500
TD		288	298	309	321	322	331	341	351
Aft Fus/Max	1952 (88)	343	356	370	385	541	571	599	628
TAEM		341	355	369	385	461	474	486	499
TD		290	300	310	321	316	326	335	345
Aft Fus/Max	1991 (107)	317	337	356	380	477	513	549	587
TAEM		313	333	353	378	426	446	464	484
TD		272	287	301	318	295	309	323	339
Ele Lwr Surf/Max	2168 (130)	181	181	183	188	262	262	266	275
TAEM		163	163	164	166	215	215	218	225
TD		175	174	176	181	260	259	263	273
Wng Lwr Surf/Max	2360 (85)	255	269	284	301	461	491	523	556
TAEM		242	256	272	290	425	442	458	474
TD		251	263	276	292	314	327	339	353

(1) Keq = 155
(2) Keq = 250
(3) Mach = 21.5
(4) Mach = 24.0

Temperature Effects of Early Transition

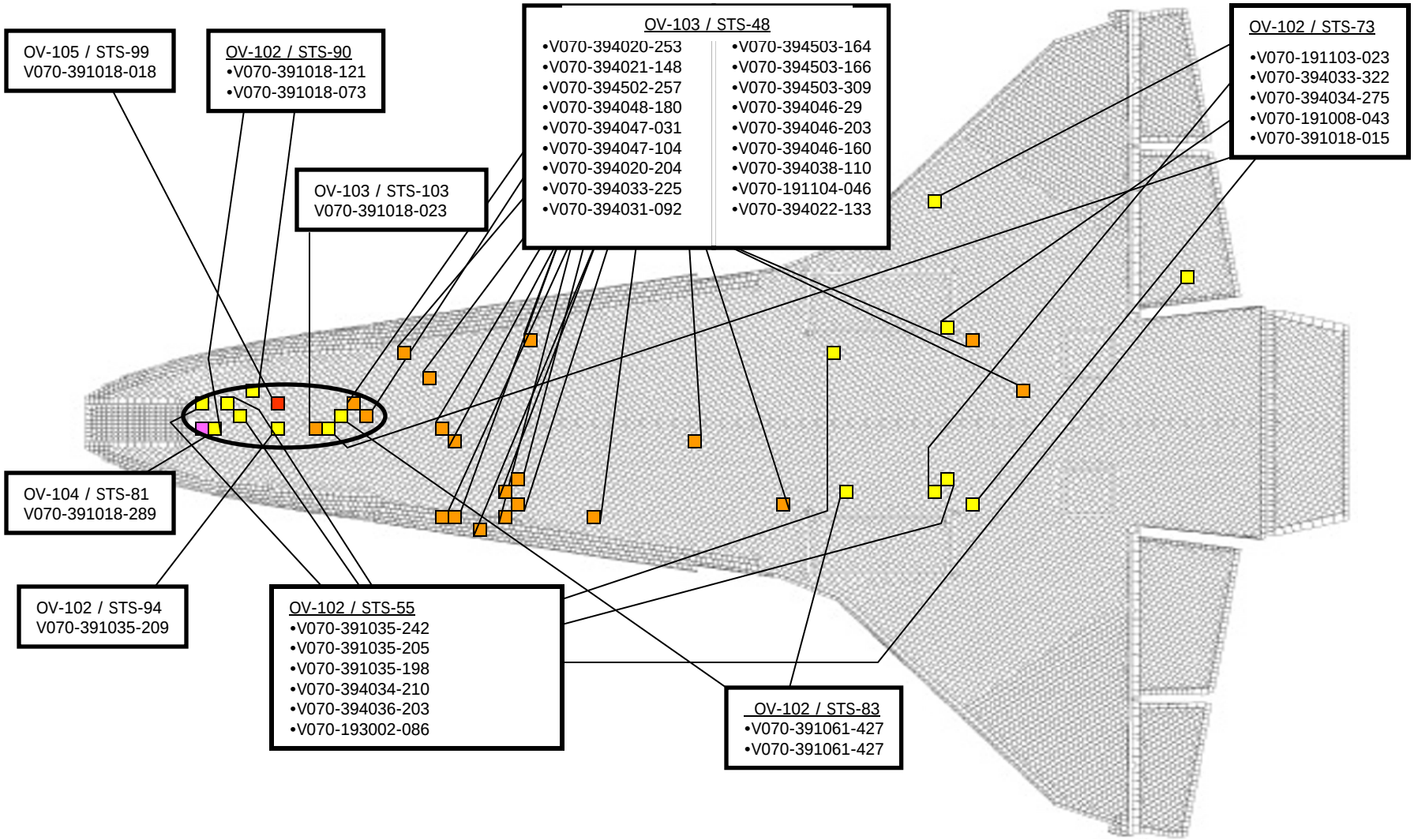
- Structural and tile bond (RTV) temperatures were evaluated
  - 1-D thermal models were run at several locations at 4 transition Machs (nominal, 18.9, 21.5, 24) combined with worst case EI temperatures
- Results show structural temperatures increase about 10degF for each increase in roughness
  - At earliest transition, structural temperatures increased above the 350F in the aft fuselage
    - More realistic EI conditions should keep all structure below 350F
- RTV temperatures increased 20degF for each increase in roughness
  - Mach 21.5 conditions produced RTV temperatures for undamaged tiles that exceed the 625F material limit in the mid fuselage
  - Mach 24 conditions produced RTV temperatures for undamaged tiles that exceed the 625F material limit in the mid and aft fuselage

TPS PRT Assessment

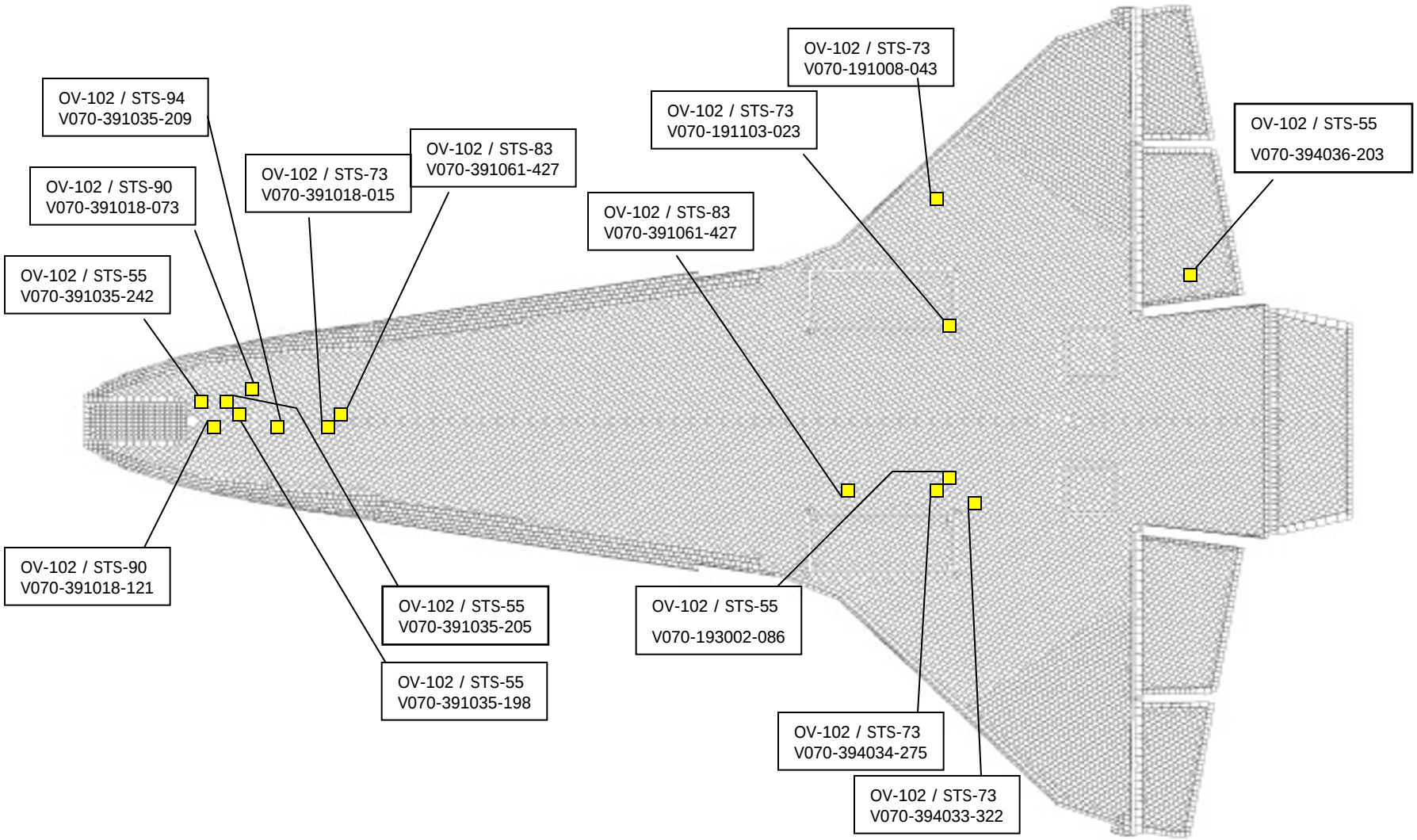
- Assessment of the TSEP body points identified negative structural margins in the aft fuselage
  - MS=-0.05 & -0.15 at mach 21.5 transition
  - MS=-0.15 (FS=1.19) & -0.30 (FS=0.98) at mach 24 transition
- RTV bondline temperature exceeded the 625F material limits in the mid fuselage at Mach 21.5 and in the mid & aft fuselage at mach 24
- This assessment did not capture impacts to penetrations/seal locations or MRs assessed to high roughness cases
  - Elevon cove and ET door thermal barriers not evaluated
  - Aft fuselage damage site will be required to be re-evaluated at the higher mach number heating
- Overall TPS perspective identifies a moderate risk due to potential errors in the assessment due to the extrapolations of multiple tools and current unknowns in penetration locations and damages not currently reassessed
- Unknowns with effect on critical areas (elevon cove, ET Door MR) coupled with limited negative margins put the TPS/STR PRT in a a position of not being able to assure safe entry

Back-Up

Protruding Gap Fillers p (F.S. mach 13+)

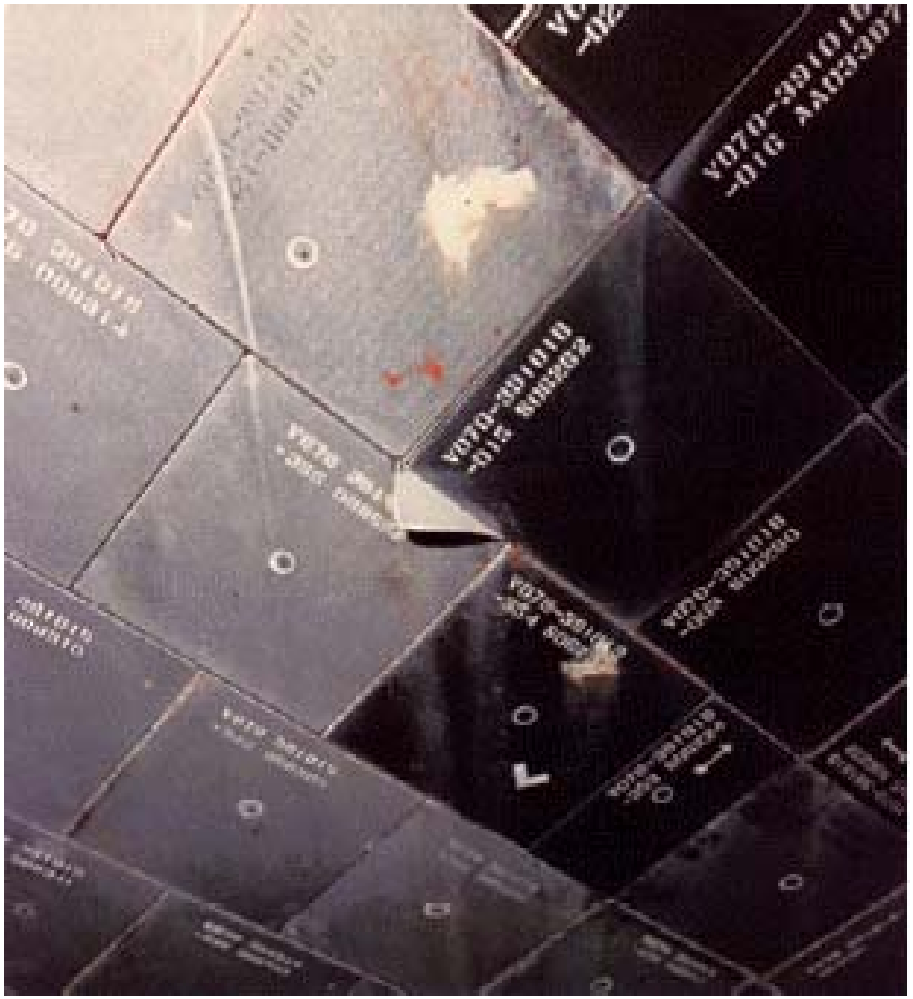


Protruding Gap Fillers OV-102



OV-102 / STS-73

Lower Forward Protruding Ames Gap Filler (Photo 21)



Detailed View of Lower Forward Ames Gap Filler (Photo 22)

OV-102 / STS-73

Mid Body Protruding Ames Gap Filler-Location 2 (Photo 23)

Mid Body Protruding Ames Gap Filler-Location 3 (Photo 24)

OV-102 / STS-73

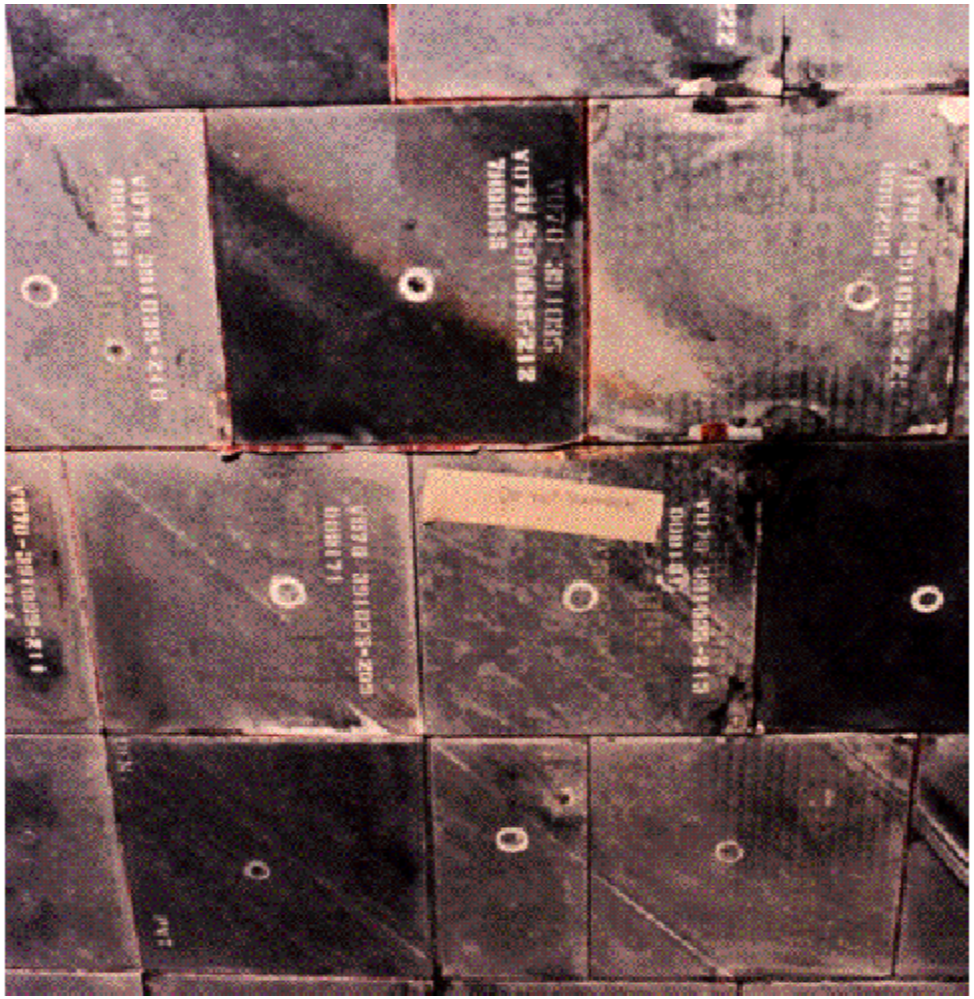
Left Wing Protruding Ames Gap Filler-Location 4 (Photo 25)

Left Wing Protruding Ames Gap Filler-Location 5 (Photo 26)

OV-102 / STS-83

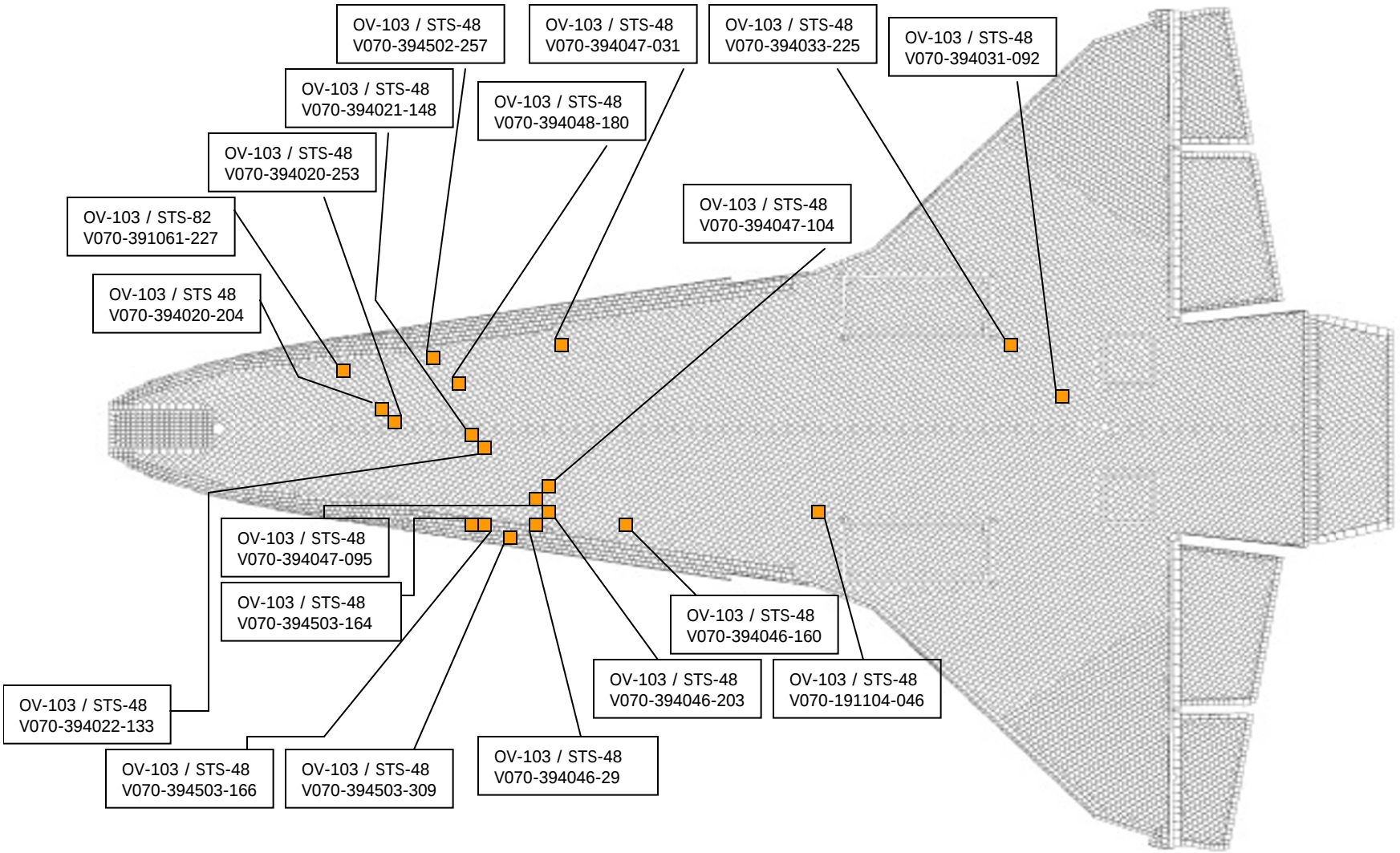
Protruding Ames Gap Filler Between Tiles V070-394035-240 and -280 (Photo 12)

OV-102 / STS-94



Protruding Ames between tiles V070-391035-209, -212, -213, and –221 (Photo 10)

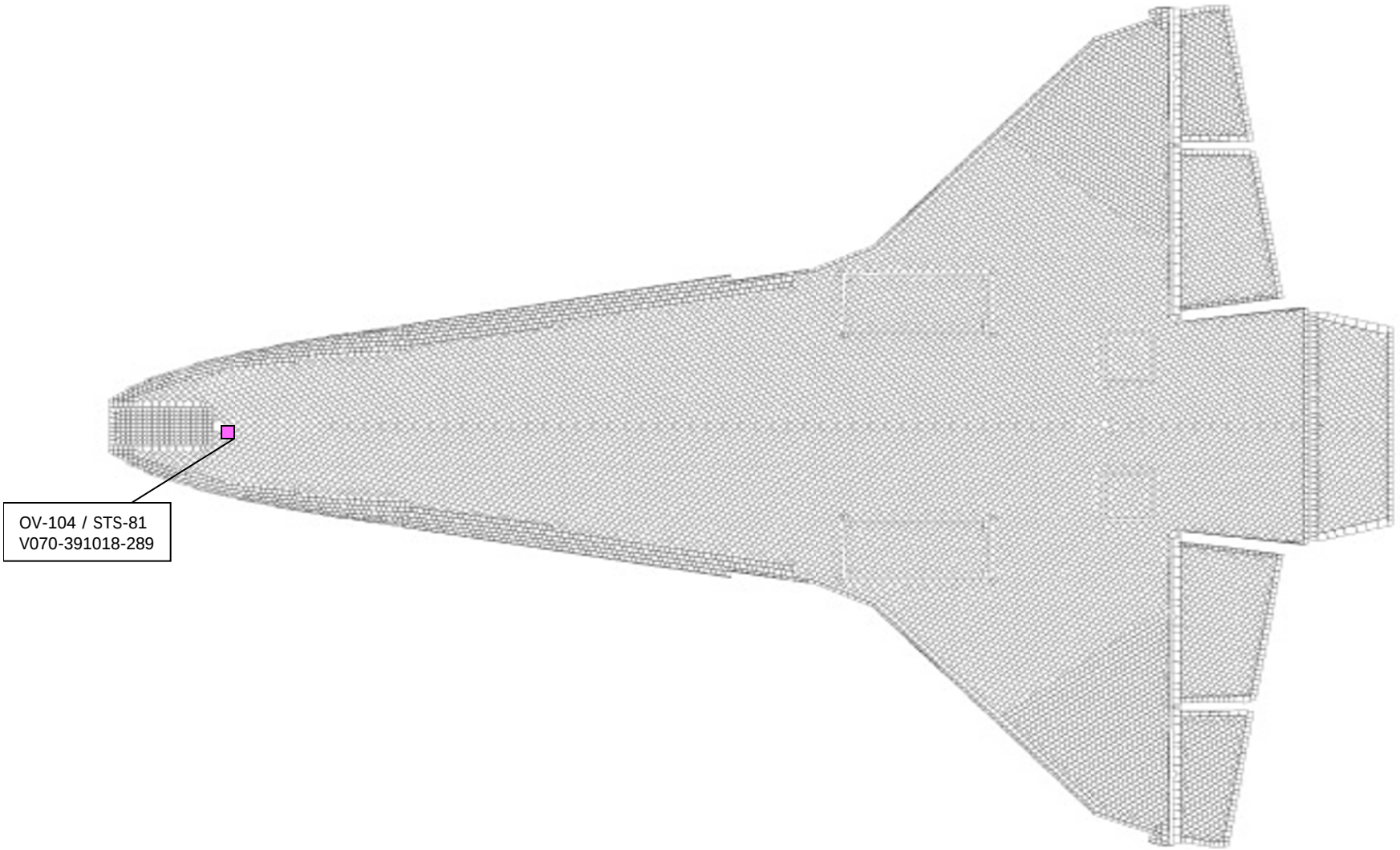
Protruding Gap Fillers OV-103



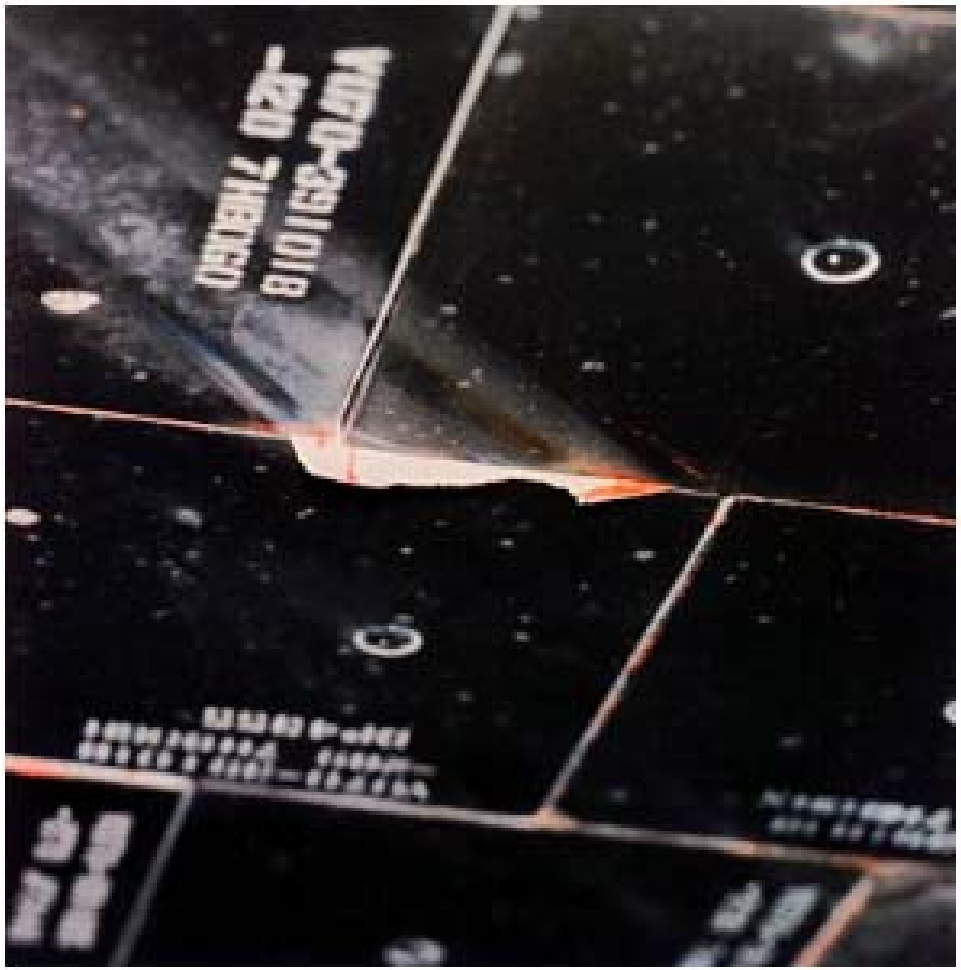
OV-103 / STS-82

Protruding Ames Gap Filler, Lower Forward Fuselage, Left Hand Side (Photo 5)

Protruding Gap Fillers OV-104

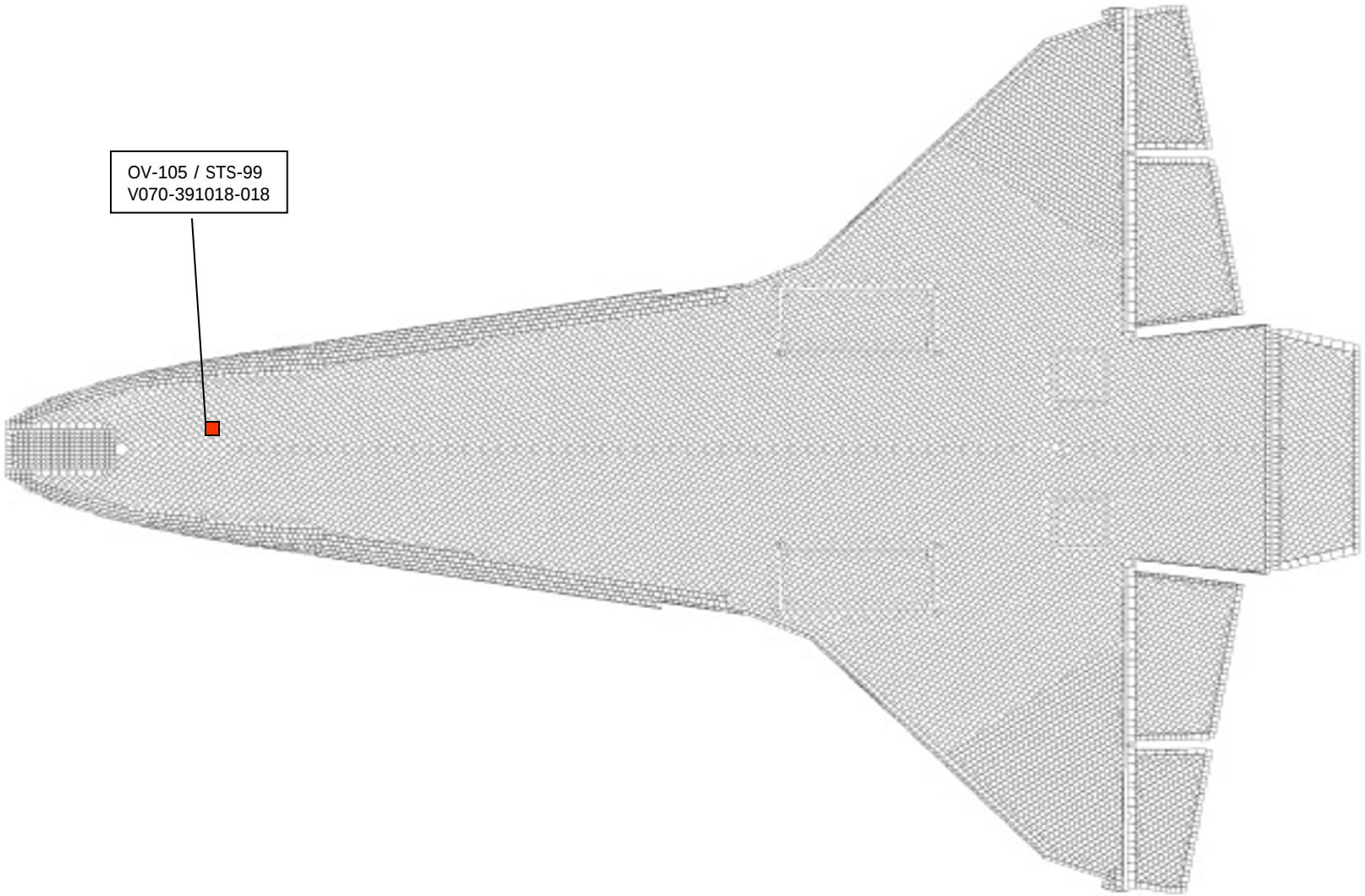


OV-104 / STS-81



Protruding Ames Gap Filler, Just Right of Centerline, Aft of NLGD (Photo 12)

Protruding Gap Fillers OV-105



Gap Filler EVA Assessment
Action 114-MMT-007

STS-114 MMT

DA8/Kelly B. Beck
Mission Operations Directorate
August 1, 2005

Action 114-MMT-007

- Develop EVA procedure to effectively eliminate concerns regarding protuberance of gap fillers.
- Develop plan to schedule EVA activity to repair gap fillers.
- Due Date 8/1/05.

Task Requirements

- Priorities
  - Remove gap fillers in both locations
    - Per TPS community, no concerns with pulling out adjacent tile
    - Maximum pull force ~5-10 lbs (for platform stability)
  - Cut gap fillers to < ~¼” step
  - Pushing in gap fillers under assessment by aero-thermal and TPS
    - Unlikely gap fillers could not be removed but could be pushed in
    - Concerns with gap fillers staying in place as gap expands with structural heating
    - Similar concern for cutting gap fillers but less material remaining to protrude

Task Requirements

- Task verification
  - If removal not possible, verify step < ¼”
  - Preferred method is crew assessment
    - Helmet cam may not be available under the Orbiter
    - Not planning on taking digital camera to minimize chance of inadvertent contact between tools and TPS
    - SRMS/OBSS views available

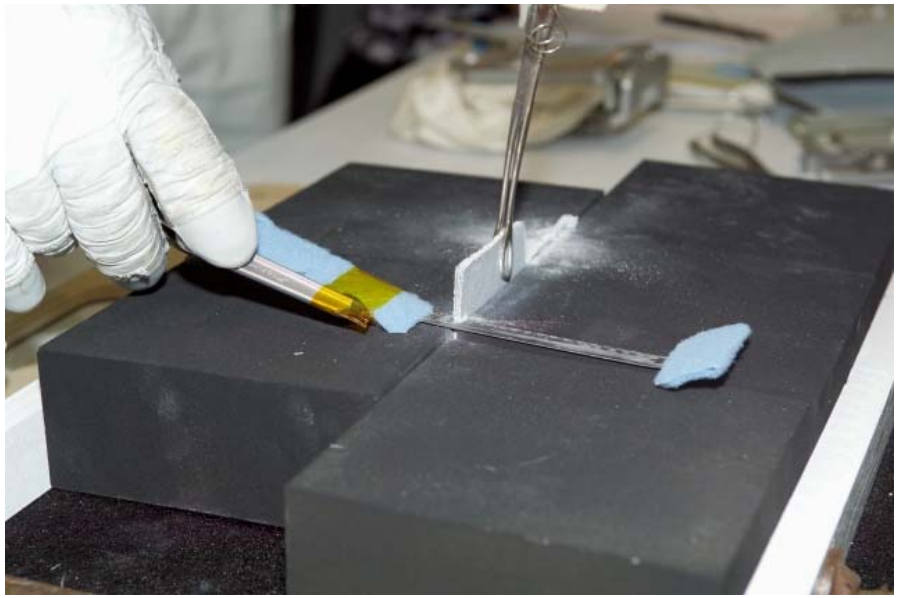
Tools and Techniques

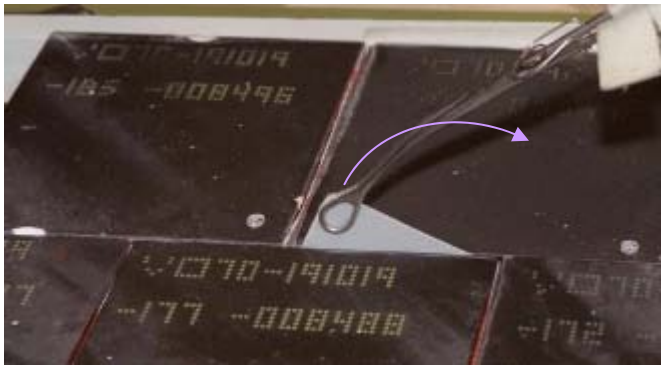
- Removal Priorities
  - Gloved hand pulling straight out, “rocking” back and forth if necessary
    - Good feel for pull force
    - Inadvertent release of the gap fillers not an immediate or long-term recontact issue
  - Grasp with EVA forceps and remove
    - Minimizes chance for inadvertent release
    - More difficult to sense pull force but not expected to significantly exceed ~10 lbs

Tools and Techniques

- Cutting Priorities
  - IVA hack saw with blade bent ~15 degrees for gloved hand clearance with adjacent tiles
    - Testing in work to verify bending does not compromise the blade in the EVA thermal environment, no issues expected
    - Consistently achieved < ¼” step
    - Dust cloud produced (less than ~1/2 gram) with sawing action
      - Open work to verify no issues with external equipment – none expected
      - No EMU issues - O2 actuator cover as used on EVA1
      - Crew health risk mitigated (wiping off gloves/suit, IV goggles/dust masks)
    - Verified no sharp edge safety issue for gloves/EMU or TPS
      - No significant damage even when purposely scraping tile with hack saw (< 2.5” x 1.5” coating loss inspection criteria)
      - Protective cover considered but dismissed due to additional complexity
      - Swatch test performed to verify glove/EMU

Building 9 Demonstration





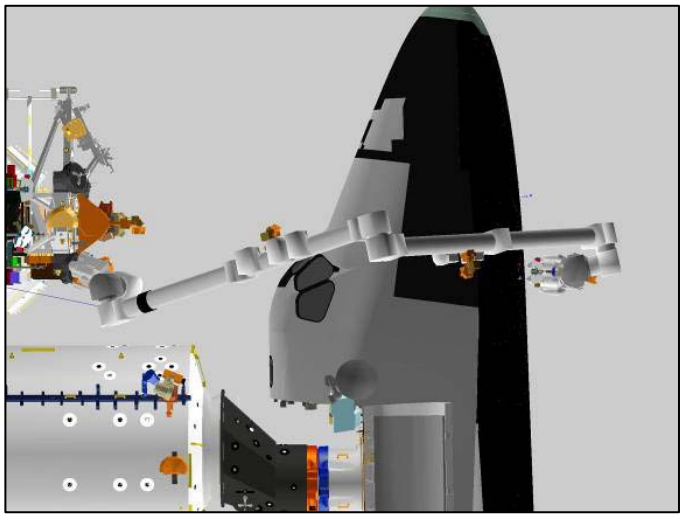
Tools and Techniques

- Cutting Priorities (cont)
  - EVA Scissors
    - Not expected to achieve ¼” step requirement
    - More difficult to use than hack saw
      - Downward cut to provide gloved hand clearance
      - Saw tooth edge results
    - More likely to result in minor damage than hack saw
      - More likely to contact adjacent tile while attempting to achieve ¼“ step than ½” step
      - Demonstration in building 9 resulted in no visible damage

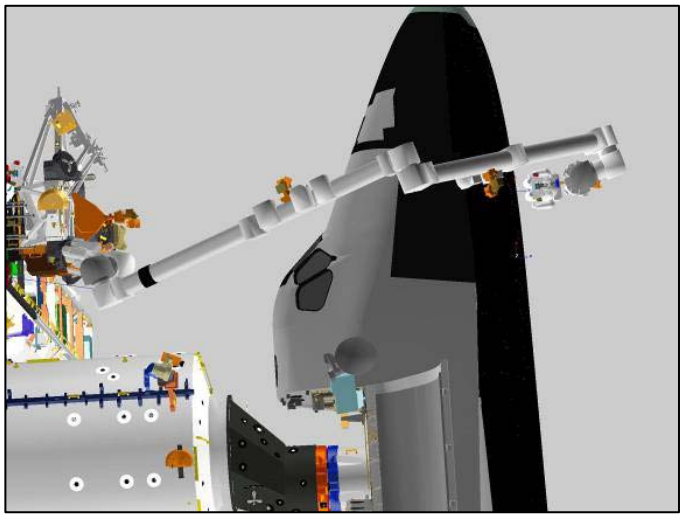
Worksite Platform

- EV CM in APFR on SSRMS based off MBS
  - Clearances > 5 ft for both gap filler locations
  - No WIF extender required
  - SRMS/OBSS available for clearance monitoring
  - Most stable platform (no brake slip, max deflection ~2-3”)
- Requires walk-off from Lab to MBS but can be accomplished in the same EVA as ESP-2 install
  - EPS-2 to pre-install day before EVA
  - 7 hour EVA allows ~1hr 15 min for gap filler task
- Other worksite platforms were evaluated but less desirable than SSRMS off MBS
  - Low clearances
  - Use of WIF extender
  - Platform stability

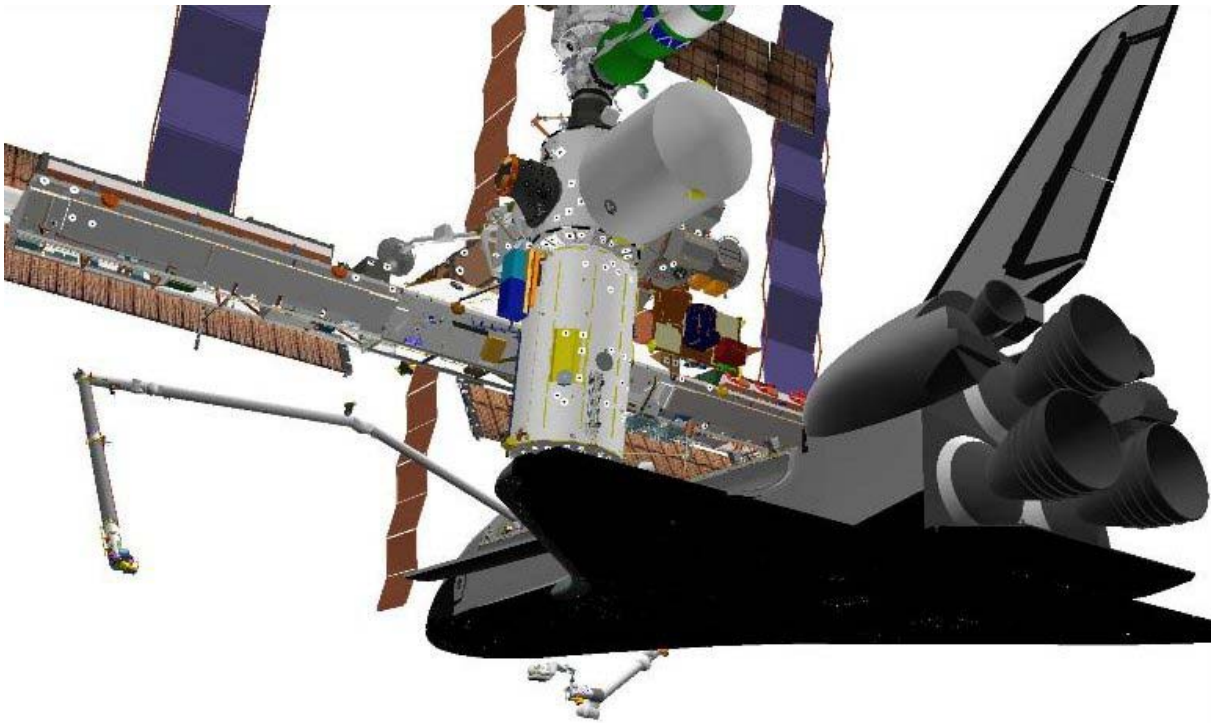
EVA on SSRMS (MBS) [133-01]



EVA on SSRMS (MBS) [134-01]



SRMS/OBSS Viewing



Recommended Timeline

- FD8: ESP-2 to preinstall, EVA tool prep, EVA procedures review, egress/10.2 depress
- FD9: EVA3 (ESP-2 install, walkoff to MBS, gap fillers), walkoff back to Lab in prep for MPLM
- FD10: Transfer, off-duty
- FD11: Middeck transfer, MPLM, OBSS handoff
- FD12: Undock, off-duty

Other Timeline Options

- Leave EVA3 as nominally planned, add 4th EVA for gap fillers
  - 4 hour EVA for gap fillers
  - No day between EVA4 and undock to avoid back to back EVAs
  - 4th EVA can be supported from a consumables perspective but requires N2 trades
    - O2 not an issue, good Shuttle margins
    - N2 cost ranges from 4 to 24 lbs, Shuttle margins currently zero but could come from ISS margins
- Planned EVA4 not recommended
  - Consider in contingency only

Risk Mitigation

- Clearance verification
  - SRMS/OBSS views
  - Lighting not expected to be an issue
  - EVA GCA protocol
  - Good comm via ISS UHF expected based on link margin analysis
- SSRMS as worksite platform
  - APFR on SSRMS without WIF extender
  - Analysis performed to verify no brake slip, 2-3” translation
- Minimize tools carried to worksite
  - NBL assessment conducted today
  - Safety tether behind crewmember

Risk Mitigation

- EVA kick loads test resulted in small “dent”
  - Less than 2.5” x 1.5” inspection criteria
  - EMU boot weighted to 50 lbs, > 125 lbs kick load
  - Developing test to assess contact with helmet cam/lights
- EWA pre-positioned near airlock
  - Not expected to be required but easy to pre-position
- LiOH instead of METOX, O2 recharge
  - Provides additional margin
- Hazards assessed and controls available
- Defer EVA3 a day if required to provide additional time for procedures verification, crew review
  - Not expected to be required but FCT/crew will continue to assess readiness

Summary

- Risks associated with gap filler robotics/EVA task and mitigation identified
- Hazards assessed and controls available
- Recommend three EVAs and only consider EVA4 in a contingency
  - EVA3 to install ESP-2 and resolve gap filler issue is supportable
  - Costs lower priority ISS objectives
  - No additional Shuttle or ISS consumables required
- Detailed procedures/timeline development in work to support modified EVA3 on FD9

Backup Charts

- Insert Overview Timelines

4th EVA Consumables Impact

ISS EVA Option	STS O2 (lbm)	STS N2 (lbm)	ISS O2 (lbm)	ISS N2 (lbm)	Comments
FD06 Margins	26	9	212	64	
ISS Airlock Exercise Protocol (10.2) ISS Tanks	0	2	18	0	N2 comes from joint cabin atmosphere.
ISS Airlock In-Suit Protocol (14.7) ISS Tanks	0	2	9	0	O2 Estimate based on previous exercise protocol data. N2 comes from joint cabin atmosphere.
ISS Airlock Exercise Protocol (10.2) STS Tanks	18	2	0	0	Requires ~3 hours for two crew to setup and teardown O2 lines.
ISS Airlock In-Suit Protocol (14.7) STS Tanks	15	2	0	0	Requires ~3 hours for two crew to setup and teardown O2 lines.

ECLSS/P. Felker, EECOM/D. Fasbender, EGIL/J. Azbell

4th EVA Consumables Impact

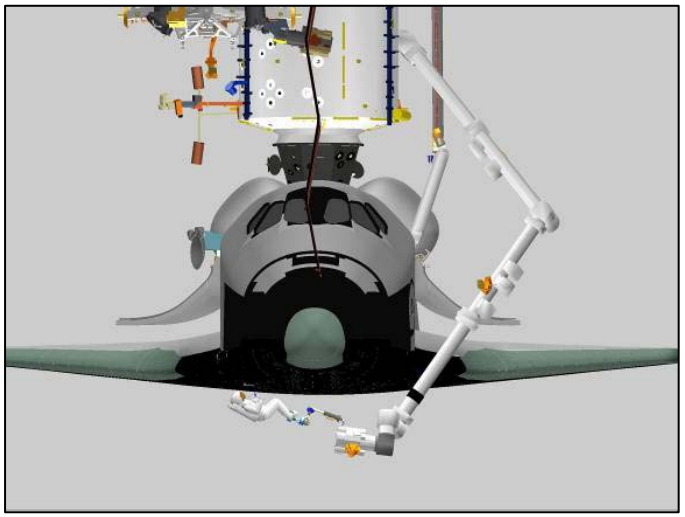
STS EVA Option	STS O2 (lbm)	STS N2 (lbm)	ISS O2 (lbm)	ISS N2 (lbm)	Comments
FD06 Margins	26	9	212	64	
STS Airlock 10.2 Protocol No Depress Pump	30	70	0	0	N2 estimate includes two depresses.
STS Airlock 10.2 Protocol With Depress Pump	27	60	0	0	10 lbm of N2 and 3 lbm O2 pumped to ISS. Crewlock hatch left open post-EVA3. N2 estimate includes two depresses.
STS Airlock 14.7 Protocol No Depress Pump	9	24	0	0	N2 estimate includes two depresses.
STS Airlock 14.7 Protocol With Depress Pump	7	13	0	0	11 lbm of N2 and 2 lbm O2 pumped to ISS.

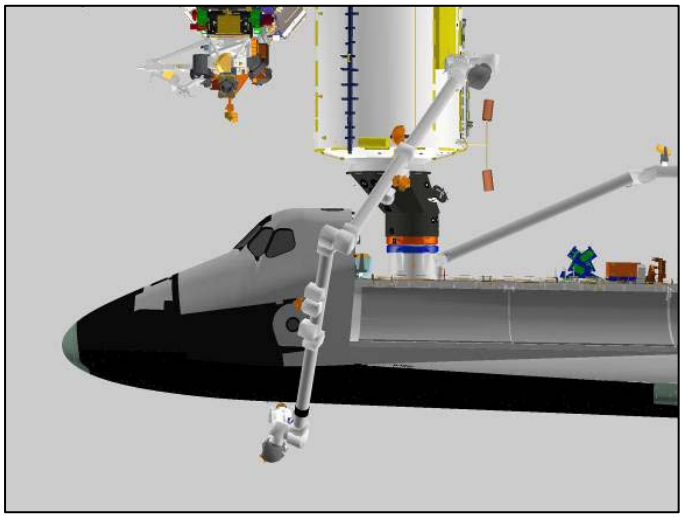
ECLSS/P. Felker, EECOM/D. Fasbender, EGIL/J. Azbell

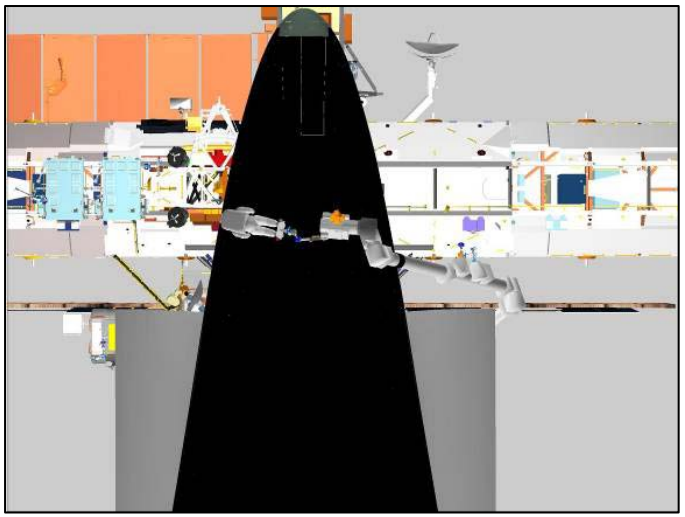
Other Worksite Platform Options

- EV on SSRMS (LAB PDGF)
  - SSRMS to Orbiter clearance ~12” for 133-01 (stbd site)
  - Requires use of WIF extender
- EV on SRMS
  - SRMS to Orbiter clearance ~15” for 133-01 (stbd site)
  - Requires use of WIF extender
  - May be able to leave OBSS on SRMS, but would increase dynamic motion. If not, would require significant time to handoff/reberth OBSS for EVA, then handoff back for MPLM
- EV on OBSS FWD/SRMS
  - Not sure PAD can be installed on OBSS FWD striker bar without damage
  - SRMS to Orbiter clearance ~38” for 133-01 (stbd site)
  - Requires use of WIF extender
- EV on OBSS MID/SRMS
  - Significant uncertainty in dynamic of SRMS/OBSS with EV crewmember on OBSS
  - MID striker bar looked at to minimize loads and increase stabilization, but could use AFT

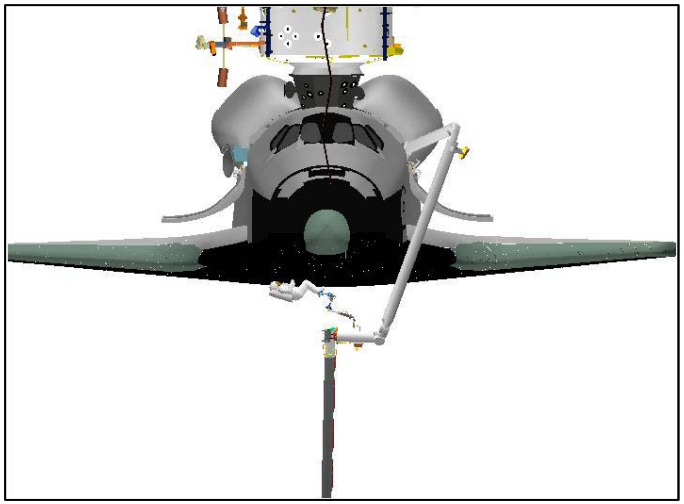
EVA on SSRMS (LAB PDGF)

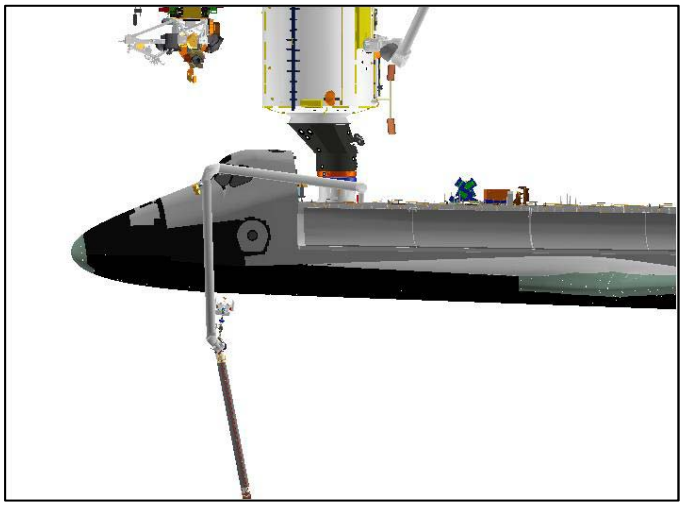


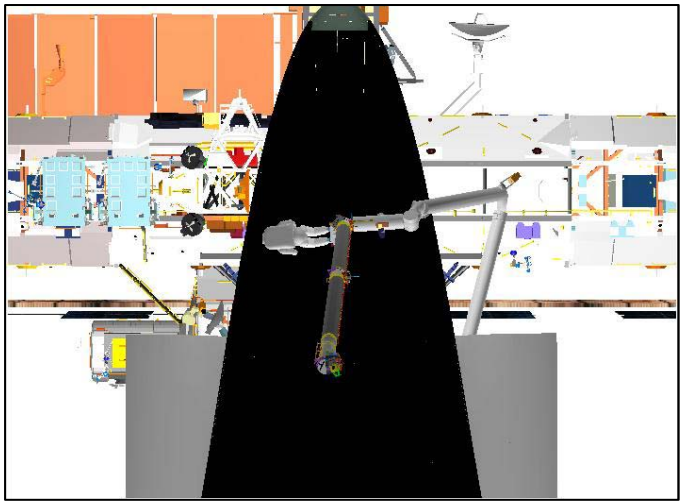




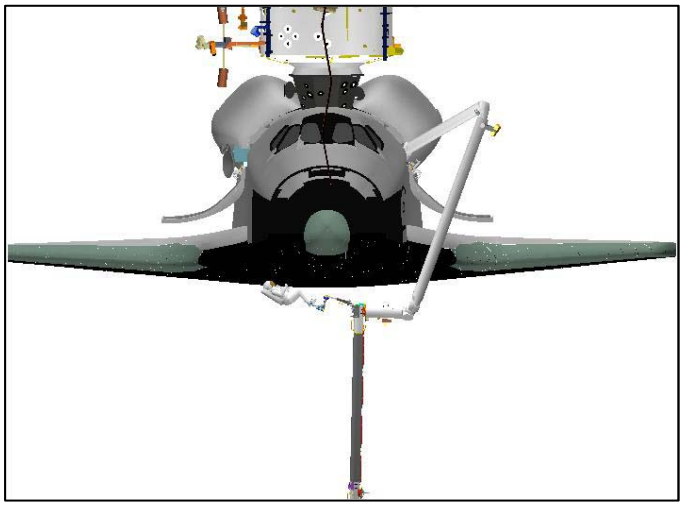
EVA on SRMS

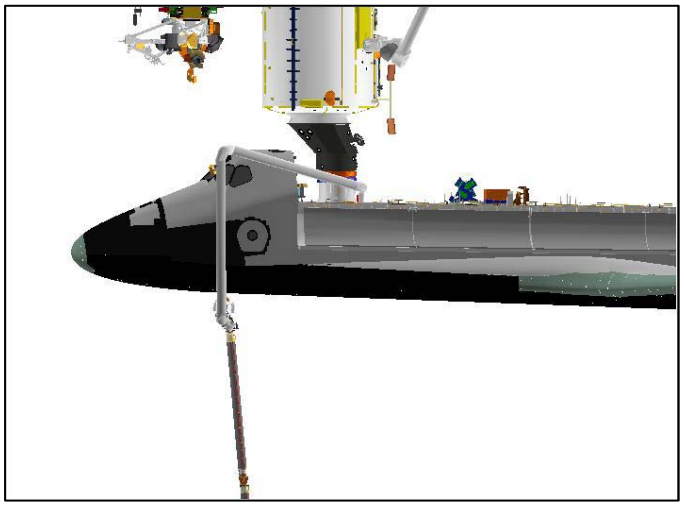


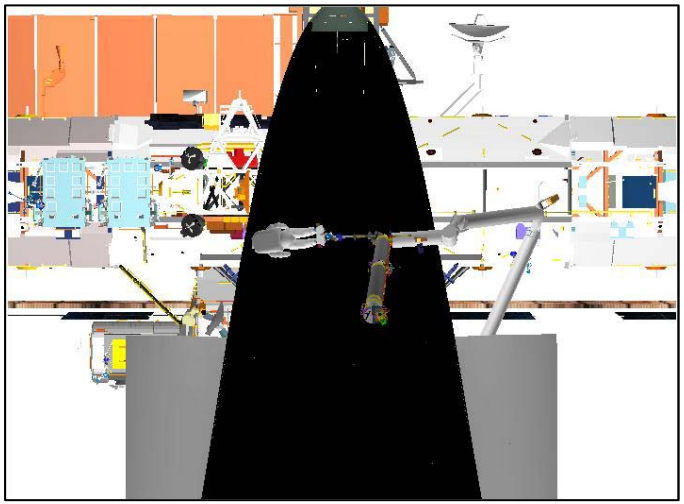




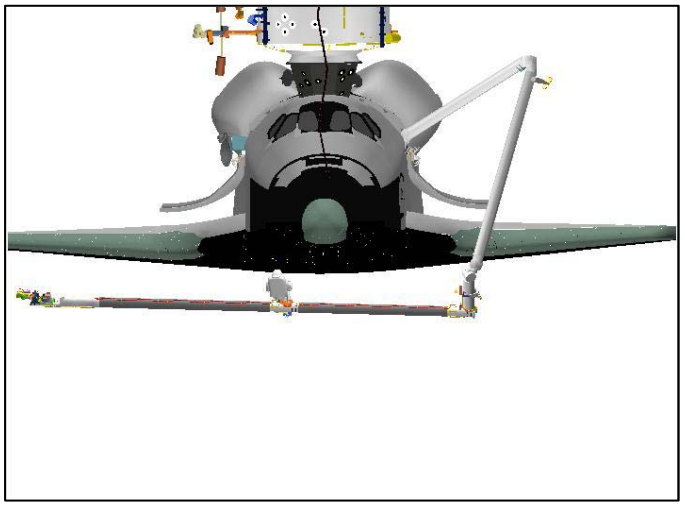
EVA on OBSS FWD/SRMS

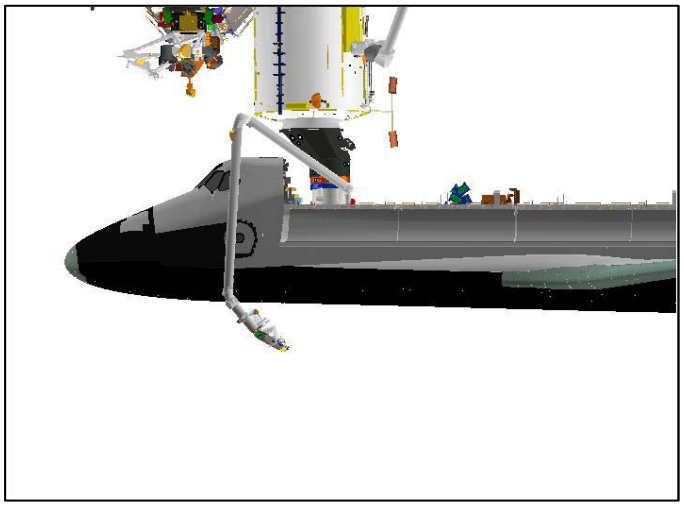


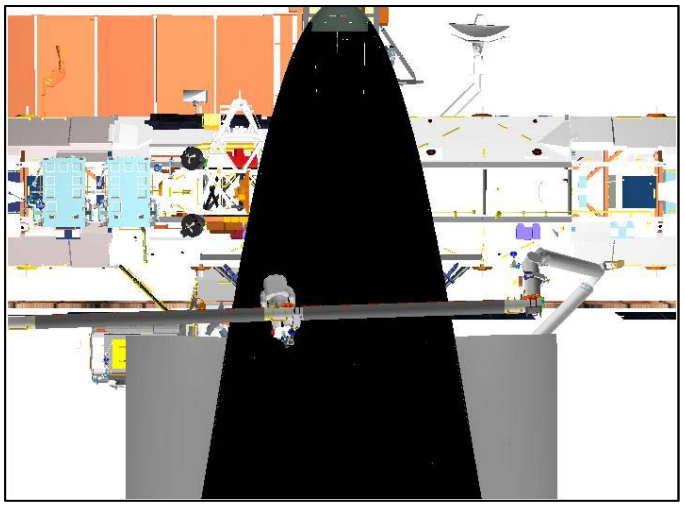




EVA on OBSS MID/SRMS







SSRMS & SRMS/OBSS Worksite Evaluation

SSRMS with Brakes On EVA load case

- No Brake Slip in +/-5 lbf & +/-10 lbf for 5 sec duration
- Shows less motion and tolerates larger forces before slipping
- Little overshoot is observed
  - (.5” overshoot for 1.7” initial motion for case considered)
- Results nearly identical for case 133-01 and 134-01

SRMS/OBSS Brakes On EVA load case

- Brake Slip occurred after 2 seconds for +/-X,+/-Z 10lbf
- Overshoot toward work site was equal to motion away from work site
  - (2.5” overshoot for 3” initial motion for case considered)
- Results nearly identical for case 133-01 and 134-01

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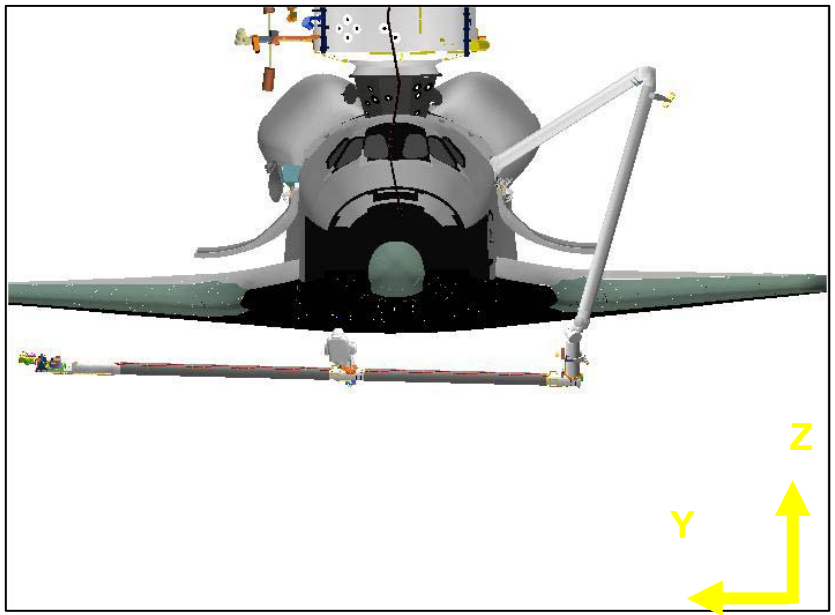
SSRMS & SRMS/OBSS Worksite Evaluation

SRMS/OBSS with EVA at Mid Transition



EVA on SSRMS

SSRMS Vs. SRMS/OBSS Brake Slip Comparison
Case 133-01

EVA Base	Force Direction	Duration of Force (sec)	Max Force Prior to Slip (lbf)	Duration of Force (sec)	Max Force Prior to Slip (lbf)
SSRMS	+/- X	0.5	48	5.0	
SRMS/OBSS	+/- X	0.5	26	5.0	8
SSRMS	+/- Y	0.5	38	5.0	18
SRMS/OBSS	+/- Y	0.5	22	5.0	18
SSRMS	+/-Z	0.5	54	5.0	27
SRMS/OBSS	+/-Z	0.5	30	5.0	8

* Input Force Terminated @ First Brake Slip

SSRMS Vs. SRMS/OBSS Brake Slip Comparison
Case 134-01

EVA Base	Force Direction	Duration of Force (sec)	Max Force Prior to Slip (lbf)	Duration of Force (sec)	Max Force Prior to Slip (lbf)
SSRMS	+/- X	0.8	46.6	5.0	
SRMS/OBSS	+/- X	0.8	17	5.0*	7
SSRMS	+/- Y	0.8	38	5.0	
SRMS/OBSS	+/- Y	0.8	15	5.0	17
SSRMS	+/-Z	0.8	46.5	5.0	27
SRMS/OBSS	+/-Z	0.8	20	5.0*	8

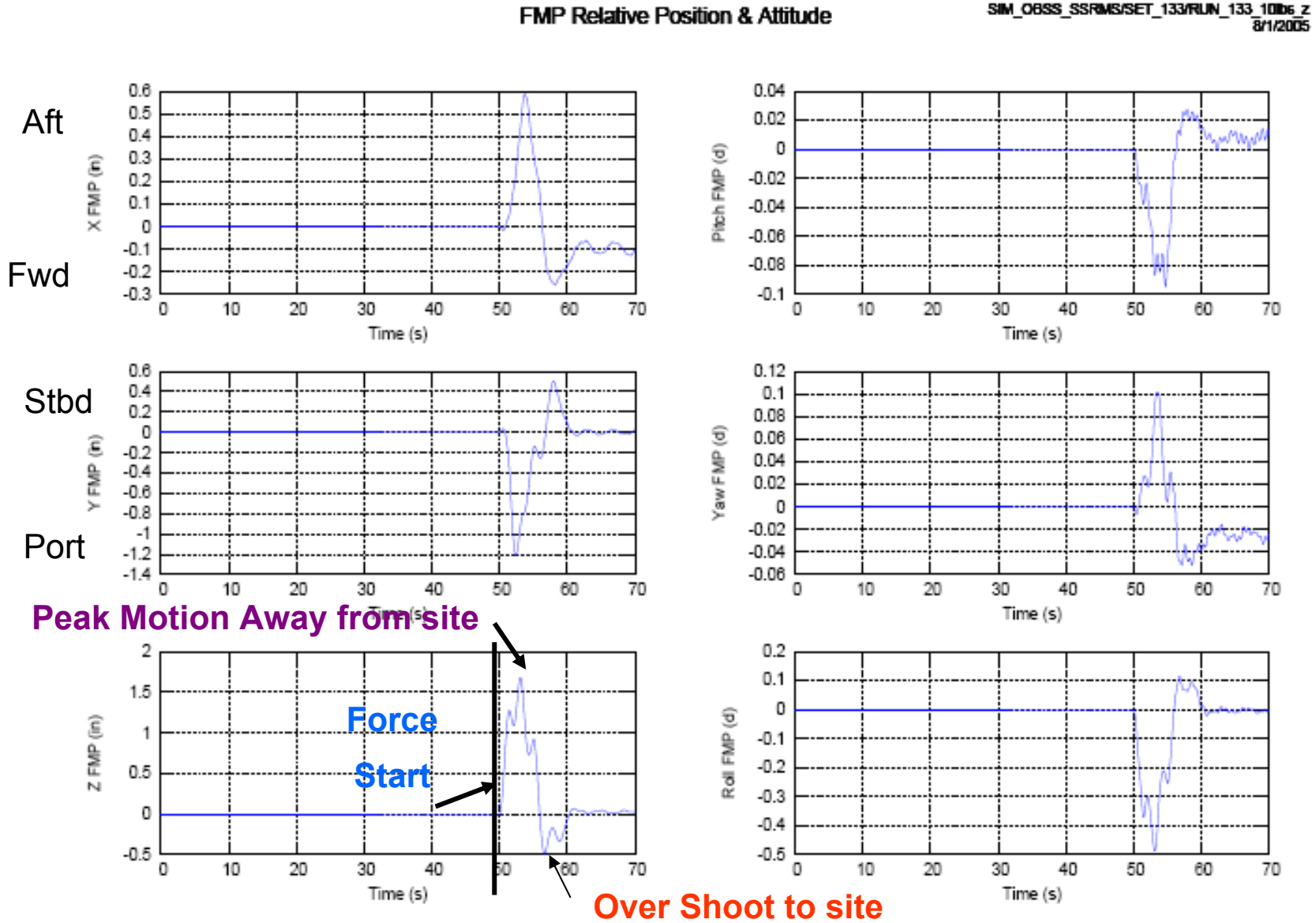
* Input Force Terminated @ First Brake Slip

SSRMS Vs. SRMS/OBSS POR Deflections
Case 133-01 & Case 134-01

EVA Base	Force Direction	Force Magnitude (lbf)	Max Trans Displacement (in)	Force Magnitude (lbf)	Max Trans Displacement (in)
SSRMS	**+/-X**	**5**	**1.7**	**10**	**3.08**
SRMS/OBSS	+/-X	5	1.8	10*	2.9*
SSRMS	**+/-Y**	**5**	**1.2**	**10**	**2.0**
SRMS/OBSS	+/-Y	5	0.6	10	1.2
SSRMS	**+/-Z**	**5**	**1.3**	**10**	**2.14**
SRMS/OBSS	+/-Z	5	1.8	10*	3.1*

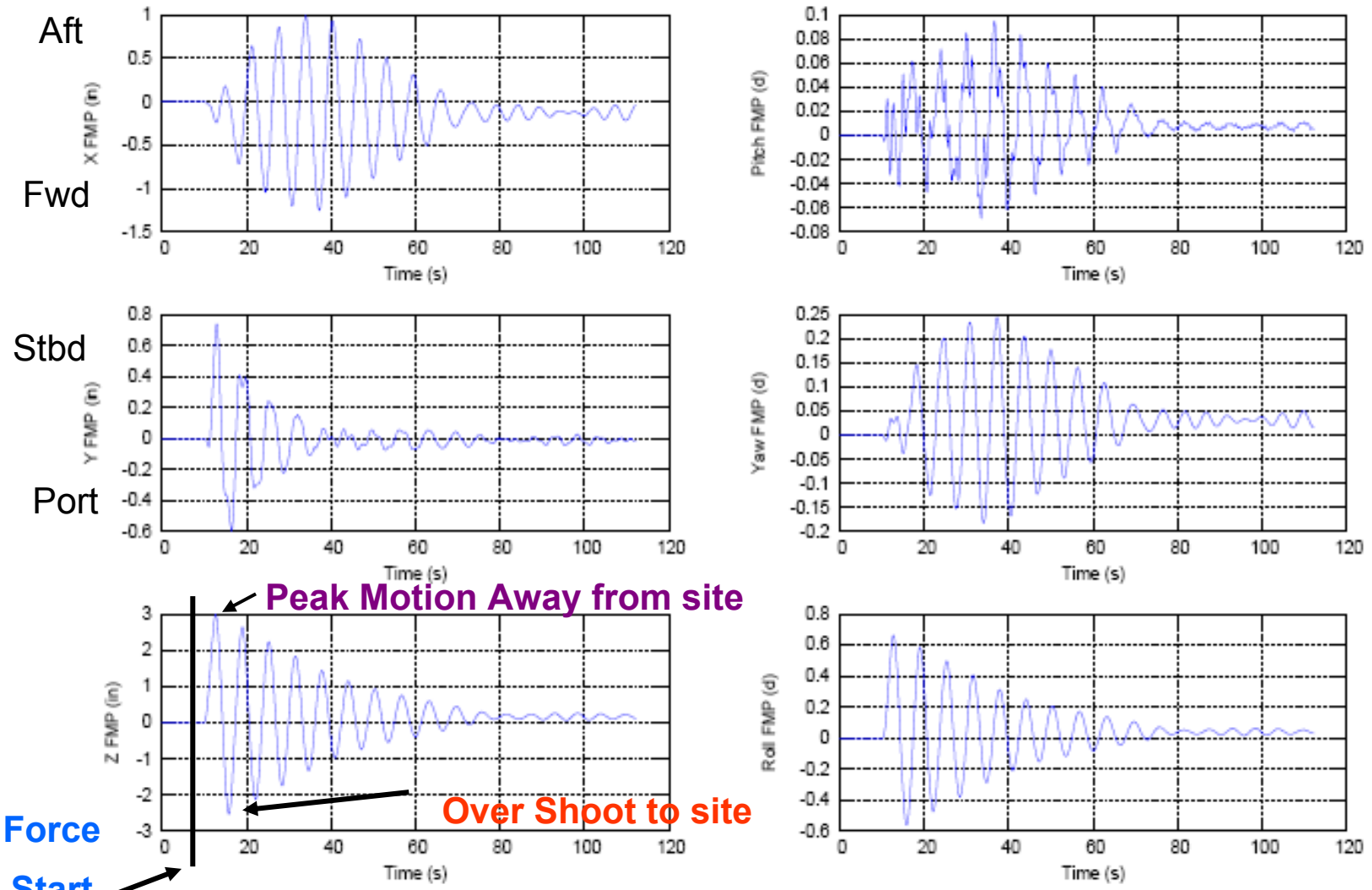
* Input Force Terminated @ First Brake Slip 2 sec after force input

SSRMS Case 133-01: 5 sec +Z 10 lb Push Force (No Brake Slip)



SRMS/OBSS Case 133-01: 2 sec +Z 10 lb Push Force, Brake Slip 2sec after input

FMP Relative Position & Attitude SIM_OBSS_WSD/SET_sunday-133/SET_sunday-con-10/RUN_sunday_+Z +Z



SRMS/OBSS Static Load Analysis of WS 133-01

- Determined the maximum force (in OBAS X, Y, Z) that could be applied without observing any brake slip for worksite 133-01.
  - •OBSS model did not include EVA mass (static load analysis)
  - •Analysis tool used rigid OBSS model
- Force applied at worksite with equal and opposite force applied to Orbiter

[OBAS]	Fx_{max} = 7.2 lbs	Fy_{max} = 16.8 lbs	Fz_{max} = 8.0 lbs
X Deflection	1.47	-0.30	-0.02
Y Deflection	-0.37	1.19	-0.83
Z Deflection	-0.07	-0.33	1.43
Pitch Deflection	0.03	0.04	-0.16
Yaw Deflection	0.20	-0.12	0.21
Roll Deflection	-0.18	-0.02	0.18

- The deflections are given in inches and degrees.

Gap Filler EVA Safety Assessment

- EVA Contact Risk (including helmet impact)
  - Loss of Situational awareness
    - OBSS/SRMS camera viewing
  - SSRMS back drive (due to pulling)….expected loads lower than limit
  - Crew control of position adequate (since contact area within view)
    - Impact loads expected to be low (not verified)
  - APFR attachment/slip failure – loads not expected to trip load limiter
- SSRMS Fail
  - 1 Fault Tolerant + EVA joint drive
- SSRMS Run Away (GCA)
  - Run away distance acceptable (inches)
- EMU problems resulting in an abort EVA
  - SSRMS brings crew back
  - If insufficient time translate down SSRMS
- Forward RCS jets
  - Inhibited
- OBSS Lasers
  - Will either be at safe distance or inhibited
- Loss of EVA communications (since GCA)
  - Predicts look good

DA8/Mark Childress

1. SETUP

Configure cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
22: Base Elbow (-95, -15)	24: Tip Elbow (-100, -10)	13: LAB Stbd Zenith (38, -8)	92: Camera C (0, 25)

Verify Unloaded Parameters – √

Verify 'Unloaded Parameters' (two) – LEE Tip, SY Held

Verify Display – ISS>ISSACS

√Vernier

Verify SSRMS at Grapple Fixture Backoff position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
-82.3	-23.2	-87.4	-115.6	-176.0	-65.7	-70.1
X	Y	Z	Pitch	Yaw	Roll	
+244	+500	+565	+179.9	0.0	+179.7	
FOR	Unloaded – LEE Tip, SY Held					
Disp	ISS>ISSACS					

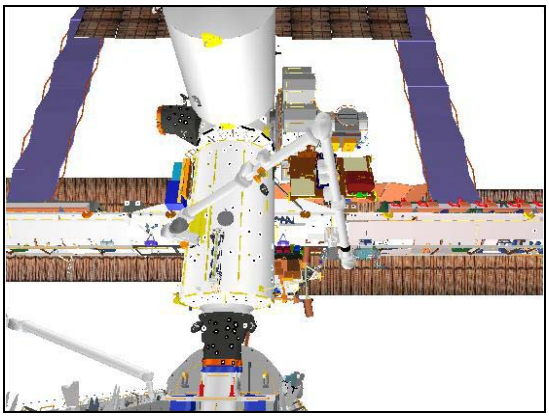


Figure 1.- Grapple Fixture Backoff Position (92: Camera C: 0, 25)

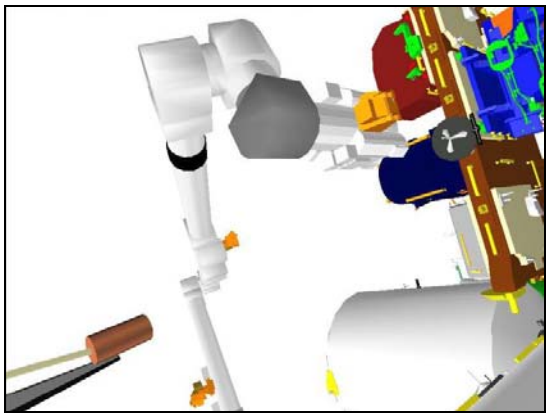


Figure 2.- Grapple Fixture Backoff Position (13: LAB Stbd Zenith: 38, -8).

2. SINGLE JOINT TO INTERMEDIATE POSITION 1

DCP BRAKES SSRMS → OFF (Verify OFF)

PCS MSS: SSRMS: SSRMS

Enter Mode – Single (Verify blue)

WARNING

The active joint must be checked on the PCS before initiating motion. Failure to do so may result in movement of the wrong joint.

DCP JOINT SELECT → ELBOW PITCH (Verify EP – Selected on PCS)

THC Perform "+" Single Joint maneuver to EP: -91.0 (THC up).

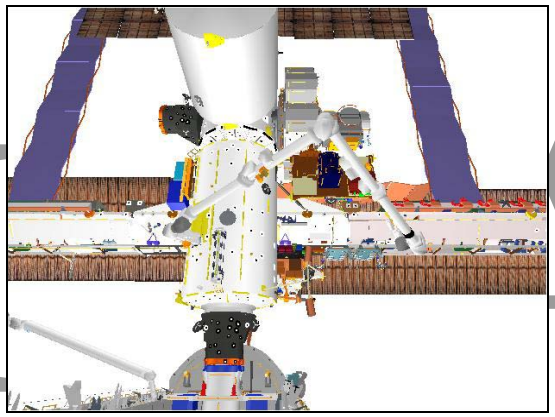


Figure 3.- Intermediate Position 1 (92: Camera C: 0, 25).

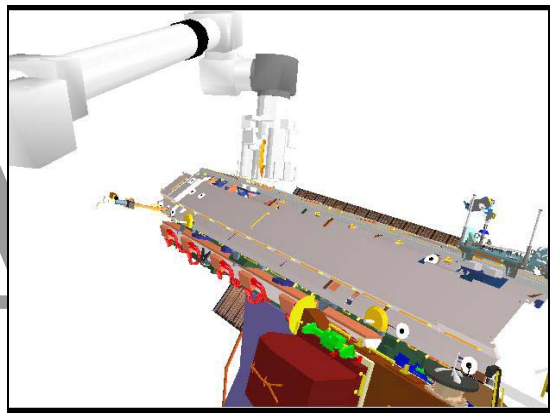


Figure 4.- Intermediate Position 1 (22: Base Elbow: -105, -25).

3. JOCAS TO INTERMEDIATE POSITION 2

PCS MSS: SSRMS: SSRMS

Enter Mode – Joint OCAS (Verify blue)

SSRMS Joint OCAS

Input 'Joint Angles' 'Destination' for Intermediate Position 2.

SR	SY	SP	EP	WP	WY	WR
-82.3	-27.2	-100.0	-91.0	-118.1	-52.5	+17.4

NOTE

The Target and Error fields on the SSRMS Joint OCAS display will not be correct. This data should be verified and monitored on the Joint Angle Position overlay. (SCR 31169)

cmd Load (Verify Sequence Status – Confirm or Cancel)

MON Verify joint angles and errors are correct on Joint Angle Position overlay.

	SR	SY	SP	EP	WP	WY	WR
(current)	-82.3	-23.2	-87.4	-91.0	-176.0	-65.7	-70.1
TGT	**-82.3**	**-27.2**	**-100.0**	**-91.0**	**-118.1**	**-52.5**	**+17.4**
ERR	0.0	+4.0	+12.6	0.0	-57.9	-13.2	-87.5

****
* If joint angles/errors are incorrect

PCS * **cmd** Cancel (Verify Sequence Status – Waiting Destination)
*
* Input correct Dest joint angles per table above.
*
* **cmd** Load (Verify Sequence Status – Confirm or Cancel)
*

MON * Verify joint angles and errors are correct on Joint Angle Position
* overlay.

****

PCS **cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

DCP AUTO SEQ → PROC

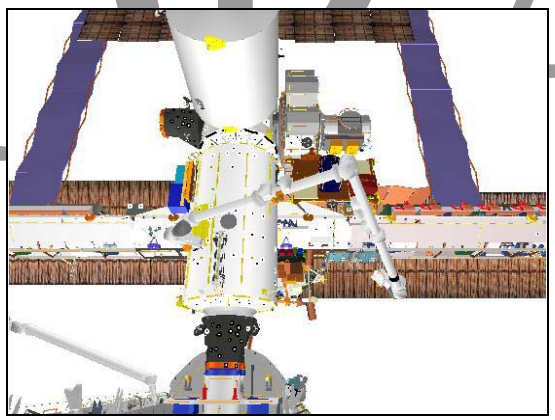


Figure 5.- Intermediate Position 2
(92: Camera C: 0, 25).

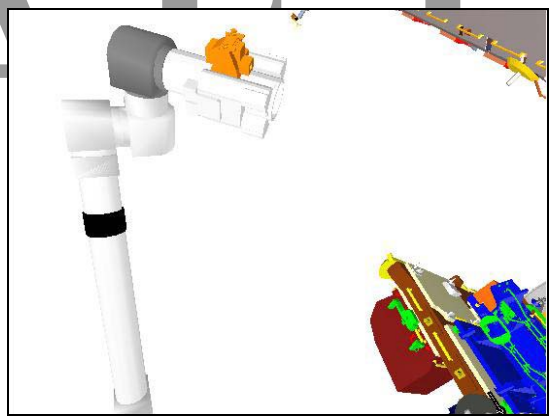


Figure 6.- Intermediate Position2
(13: LAB Stbd Zenith: 38, 32).

PCS MSS: SSRMS: SSRMS

Verify Posn Hold – orange

Verify SSRMS at Intermediate Position 2 (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
-82.3	-27.2	-100.0	-91.0	-118.1	-52.5	+17.4
X	Y	Z	Pitch	Yaw	Roll	
+416	+723	+433	+155.1	-26.9	-160.4	
FOR	Unloaded – LEE Tip, SY Held					
Disp	ISS>ISSACS					

4. SINGLE JOINT TO MBS PDGF 1 PRE-GRAPPLE POSITION

NOTE
Base Elbow camera can be used during this maneuver to monitor clearance between the Base Boom and the Lab. Minimum clearance is 76 cm.

PCS MSS: SSRMS: SSRMS

Enter Mode – Single (Verify blue)

WARNING
The active joint must be checked on the PCS before initiating motion. Failure to do so may result in movement of the wrong joint.

THC Perform Single Joint maneuver to MBS PDGF 1 PRE-GRAPPLE position (within 1 deg).

	SR	SY	SP	EP	WP	WY	WR
Intermediate Position 2	-82.3	-27.2	-100.0	-91.0	-118.1	-52.5	+17.4
1: SR +	-68.1						
2: SP –			-125.6				
MBS PDGF 1 Pre-Grapple	-68.1	-27.2	-125.6	-91.0	-118.1	-52.5	+17.4
	X	Y	Z	Pitch	Yaw	Roll	
	+481	+507	+136	+161.4	-33.5	-136.0	
	FOR	Unloaded – LEE Tip, SY Held					
	Disp	ISS>ISSACS					

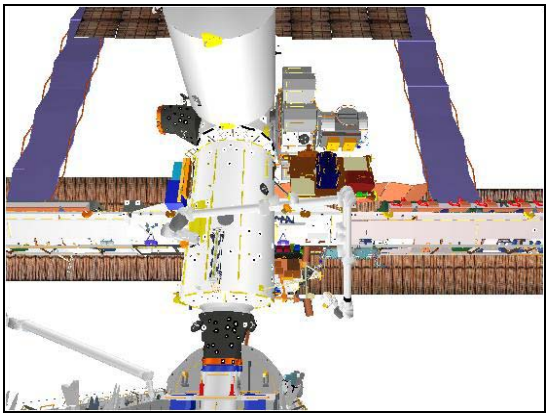


Figure 7.- MBS PDGF 1 Pre-grapple (92: Camera C: 0, 25).

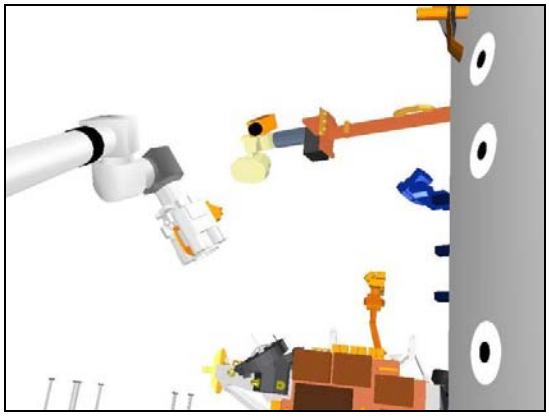


Figure 8.- MBS PDGF 1 Pre-grapple (22: Base Elbow: -95, -15).

PCS MSS: SSRMS: SSRMS

Enter Mode – Standby (Verify blue)

Change Loaded Parameters ▶ Walk Off ▶ MBS PDGF 1
Verify ‘Loaded Parameters’ (two) – MBS PDGF 1, SR Held

Change Unloaded Parameters ▶ Unloaded ▶ LEE Tip SRH
Verify ‘Unloaded Parameters’ (two) – LEE Tip, SR Held

Change Display ▶ ISS ▶ W4MBS PDGF 1 (Verify ISS>W4MBS PDGF 1)

1. SETUP

Configure cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
22: Base Elbow (-95, -15)	24: Tip Elbow (-15, 15)	13: LAB Stbd Zenith (38, -8)	92: Camera C (0,25)

Verify Unloaded Parameters – √

Change Unloaded Parameters ▶ Unloaded ▶ LEE Tip SYH
Verify 'Unloaded Parameters' (two) – LEE Tip, SY Held

Change Display ▶ ISS ▶ ISSACS (Verify ISS>ISSACS)

√Vernier

Verify SSRMS at MBS PDGF 1 Pre-Grapple position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
-68.1	-27.2	-125.6	-91.0	-118.1	-52.5	+17.4
X	Y	Z	Pitch	Yaw	Roll	
+481	+507	+136	+161.4	-33.5	-136.0	
FOR	Unloaded – LEE Tip, SY Held					
Disp	ISS>ISSACS					

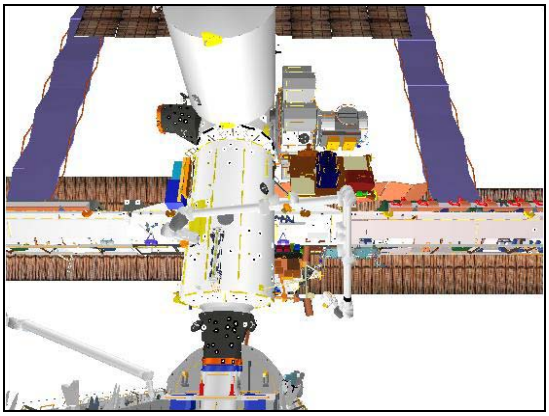


Figure 1.- MBS PDGF 1 Pregrapple Position
(92: Camera C: 0, 25).

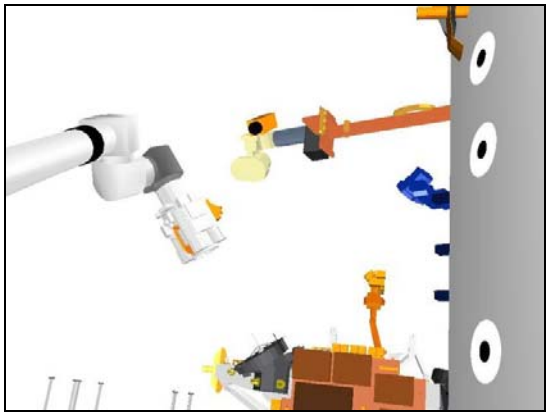


Figure 2.- MBS PDGF 1 Pregrapple Position
(22: Base Elbow: -95, -15).

2. SINGLE JOINT SEQUENCE TO INTERMEDIATE POSITION 1

DCP BRAKES SSRMS → OFF (Verify OFF)

PCS MSS: SSRMS: SSRMS

Enter Mode – Single (Verify blue)

WARNING

The active joint must be checked on the PCS before initiating motion. Failure to do so may result in movement of the wrong joint.

THC Perform Single Joint maneuver to Intermediate Position 1 (within 1 deg).

	SR	SY	SP	EP	WP	WY	WR
MBS PDGF 1 Pre-Grapple	-68.1	-27.2	-125.6	-91.0	-118.1	-52.5	+17.4
1: SP +			-100.0				
2: SR –	-82.3						
Intermediate Position 1	-82.3	-27.2	-100.0	-91.0	-118.1	-52.5	+17.4

X	Y	Z	Pitch	Yaw	Roll
+416	+723	+433	+155.1	-26.9	-160.4
FOR	Unloaded – LEE Tip, SY Held				
Disp	ISS>ISSACS				

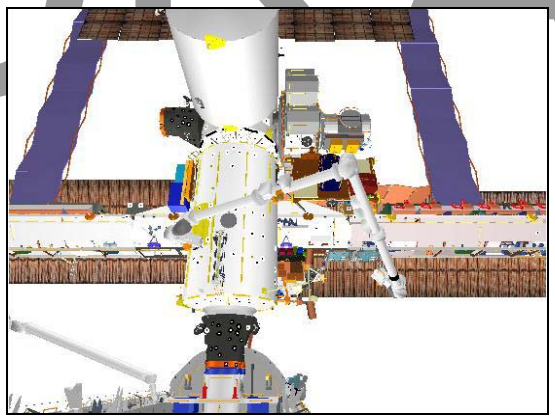


Figure 3.- Intermediate 1
(92: Camera C: 0, 25).

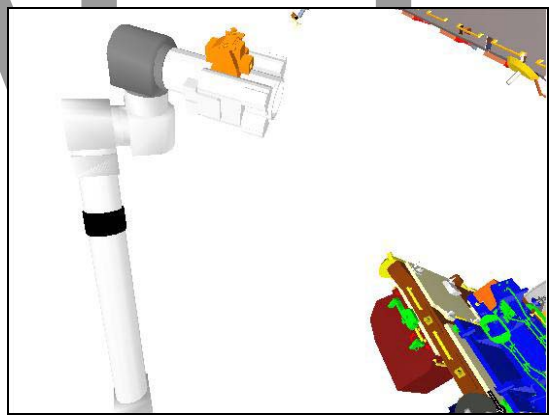


Figure 4.- Intermediate 1
(13: LAB Stbd Zenith: 38, 32).

3. JOINT OCAS TO INTERMEDIATE POSITION 2

PCS MSS: SSRMS: SSRMS

Enter Mode – Joint OCAS (Verify blue)

SSRMS Joint OCAS

Input ‘Joint Angles’ ‘Destination’ for ESP2 Intermediate 2 Position.

SR	SY	SP	EP	WP	WY	WR
-82.3	-23.2	-87.4	-91.0	-176.0	-65.7	-70.1

NOTE
The Target and Error fields on the SSRMS Joint OCAS display will not be correct. This data should be verified and monitored on the Joint Angle Position overlay. (SCR 31169)

cmd Load (Verify Sequence Status – Confirm or Cancel)

MON Verify joint angles and errors are correct on Joint Angle Position overlay.

	SR	SY	SP	EP	WP	WY	WR
(current)	-82.3	-27.2	-100.0	-91.0	-118.1	-52.5	+17.4
TGT	**-82.3**	**-23.2**	**-87.4**	**-91.0**	**-176.0**	**-65.7**	**-70.1**
ERR	0.0	-4.0	-12.6	0.0	+57.9	+13.2	+87.5

****
* If joint angles/errors are incorrect
PCS * **cmd** Cancel (Verify Sequence Status – Waiting Destination)
*
* Input correct Dest joint angles per table above.
*
* **cmd** Load (Verify Sequence Status – Confirm or Cancel)
*
MON * Verify joint angles and errors are correct on Joint Angle Position
* overlay.
****

PCS **cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

DCP AUTO SEQ → PROC

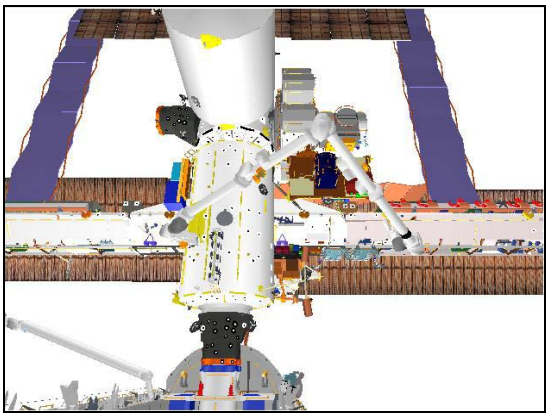


Figure 5.- Intermediate 2
(92: Camera C: 0, 25).

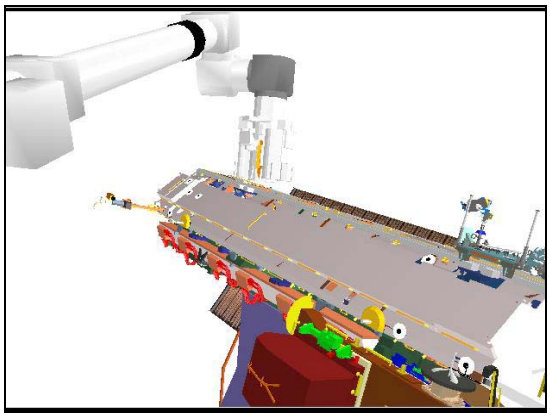


Figure 6.- Intermediate 2
(22: Base Elbow: -105, -25).

PCS MSS: SSRMS: SSRMS

Verify Posn Hold – orange

Verify SSRMS at Intermediate 2 Position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
-82.3	-23.2	-87.4	-91.0	-176.0	-65.7	-70.1
X	Y	Z	Pitch	Yaw	Roll	
+239	+762	+671	+174.6	-8.6	+156.8	
FOR	Unloaded – LEE Tip, SY Held					
Disp	ISS>ISSACS					

4. SINGLE JOINT TO ESP-2 GRAPPLE FIXTURE BACKOFF POSITION

PCS MSS: SSRMS: SSRMS

Enter Mode – Single (Verify blue)

WARNING

The active joint must be checked on the PCS before initiating motion. Failure to do so may result in movement of the wrong joint.

DCP JOINT SELECT → ELBOW PITCH (Verify EP – Selected on PCS)

THC Perform "–" Single Joint maneuver to EP: -115.6 (THC down).

Verify SSRMS at ESP-2 Grapple Fixture Backoff position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
-82.3	-23.2	-87.4	-115.6	-176.0	-65.7	-70.1
X	Y	Z	Pitch	Yaw	Roll	
+244	+500	+565	+179.9	0.0	+179.7	
FOR	Unloaded – LEE Tip, SY Held					
Disp	ISS>ISSACS					

DCP BRAKES SSRMS → ON (Verify ON)

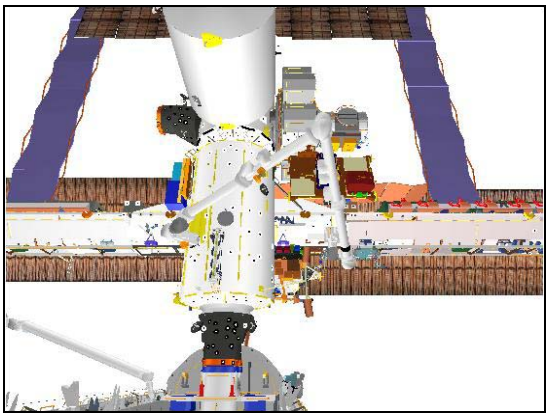


Figure 7.- ESP-2 Grapple Fixture Backoff (92: Camera C: 0, 25)

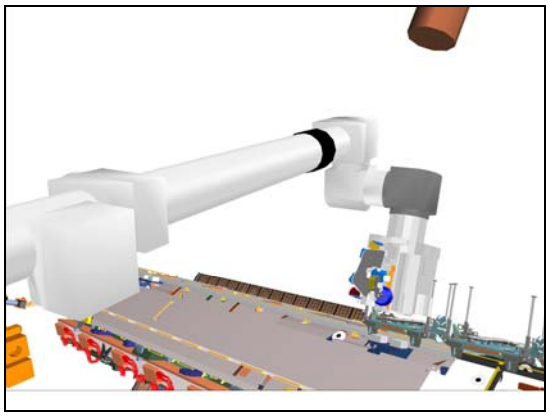


Figure 8.- ESP-2 Grapple Fixture Backoff (22: Base Elbow: -95, -15)

1. SETUP

Verify SRMS at Gap Filler Viewing position.

NOTE
SRMS joint angles at Gap Filler Viewing position are as follows: SY: +95.0, +38.7, -22.8, -0.5, -0.3, -100: WR

Configure cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
13: LAB Stbd Zenith (50, -6)	24: Tip Elbow (-20, 0) 22: Base Elbow (-90, -15)	92: Camera C (0, 20)	OBSS ITVC (70, -45)

NOTE
Throughout the procedure, monitor clearance between the SSRMS Base cluster and LAB Stbd Zenith Camera with the Base Elbow camera. Minimum clearance varies based on Pan and Tilt of the Lab Stbd Zenith camera, but may be as little as 75 cm.

PCS MSS: SSRMS: SSRMS

Verify 'Unloaded Parameters' (two) – LEE Tip, SY Held

Change Display ▶ W4 ▶ ISSACS (Verify W4>ISSACS)

Change Command ▶ W4 ▶ ISSACS (Verify W4>ISSACS)

√Vernier

Verify SSRMS at LAB PDGF Pre-Grapple position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+34.0	+58.9	-104.3	-82.6	-132.3	+16.8	-72.8
X	Y	Z	Pitch	Yaw	Roll	
+352	-236	+791	+90.0	+37.6	+180.0	
FOR	Unloaded – LEE Tip, SY Held					
Disp	W4>ISSACS					

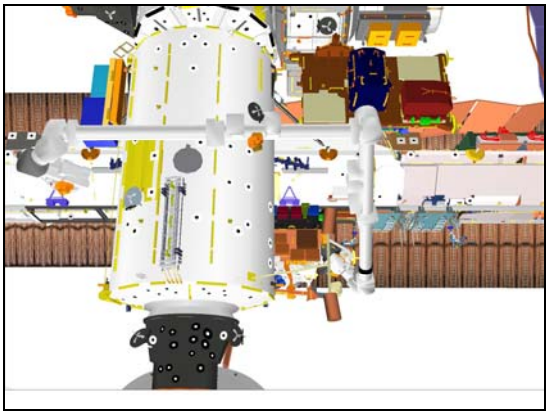


Figure 1.- LAB PDGF Pre-Grapple (92: Camera C: 0, 20).

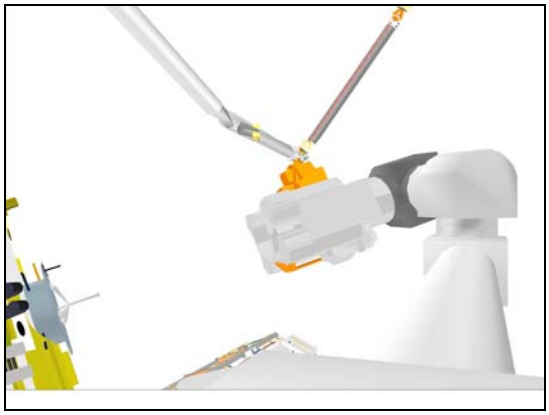


Figure 2.- LAB PDGF Pre-Grapple (24: Tip Elbow: -20, 0).

2. APFR INSTALL AND INGRESS

DCP BRAKES SSRMS → OFF (Verify OFF)

NOTE

1. Monitor clearance between the Tip LEE and LAB with the Tip Elbow camera. Minimum clearance is 119 cm.
2. Monitor clearance between the SSRMS Base Boom and ESP2 with the LAB Stbd Zenith Camera. If ESP2 GF not removed, minimum clearance is 129 cm.

PCS MSS: SSRMS: SSRMS

Enter Mode – Joint OCAS (Verify blue)

SSRMS Joint OCAS

Input 'Joint Angles' 'Destination' for APFR Install/Ingress position.

SR	SY	SP	EP	WP	WY	WR
+29.8	+58.9	-71.1	-111.3	-34.1	+18.1	-9.4

NOTE

The Target and Error fields on the SSRMS Joint OCAS display will not be correct. This data should be verified and monitored on the Joint Angle Position overlay. (SCR 31169)

cmd Load (Verify Sequence Status – Confirm or Cancel)

MON Verify joint angles and errors are correct on Joint Angle Position overlay.

	SR	SY	SP	EP	WP	WY	WR
(current)	+34.0	+58.9	-104.3	-82.6	-132.3	+16.8	-72.8
TGT	**+29.8**	**+58.9**	**-71.1**	**-111.3**	**-34.1**	**+18.1**	**-9.4**
ERR	+4.2	0.0	-33.2	+28.7	-98.2	-1.3	-63.4

****
* If joint angles/errors are incorrect
PCS * | **cmd** Cancel (Verify Sequence Status – Waiting Destination)
*
* | Input correct Dest joint angles per table above.
*
* | **cmd** Load (Verify Sequence Status – Confirm or Cancel)
*
MON * | Verify joint angles and errors are correct on Joint Angle Position
* | overlay.
****

PCS **cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

DCP AUTO SEQ → PROC

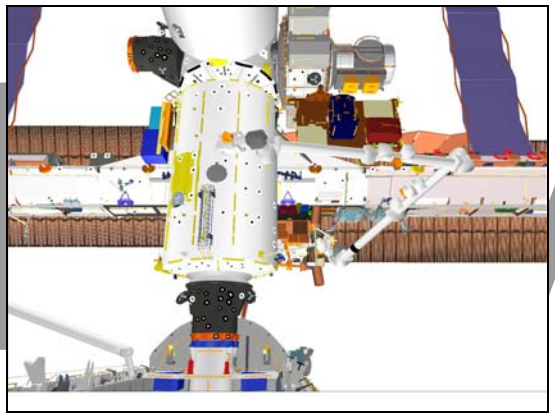


Figure 3.- APFR Install/Ingress
(92: Camera C: 0, 20).

Figure 4.- APFR Install/Ingress
(24: Tip Elbow: -20, 0).

PCS MSS: SSRMS: SSRMS

Verify Posn Hold – orange

Verify SSRMS at APFR Install/Ingress position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+29.8	+58.9	-71.1	-111.3	-34.1	+18.1	-9.4
X	Y	Z	Pitch	Yaw	Roll	
+248	+36	+921	+97.8	-61.6	-70.4	
FOR	Unloaded –LEE Tip, SY Held					
Disp	W4>ISSACS					

NOTE
APFR settings are (12, PP, F, 6).

PCS MSS: SSRMS: SSRMS

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock: Joint Lock

cmd Shoulder Yaw (Verify SY – Locked)

THC/ RHC GCA per EVA call for APFR Install and Ingress.

3. MANEUVER TO CLEAR STRUCTURE POSN
On EVA GO, APFR ingress complete:

PCS MSS: SSRMS: SSRMS

Enter Mode – Standby (Verify blue)

Change Unloaded Parameters ▶ EVA ▶ Chest 12/PP/F/6 SYH
Verify 'Unloaded Parameters' (two) – Chest 12/PP/F/6, SY Held

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock: Joint Lock

cmd Shoulder Yaw (Verify SY – Locked)

THC/ RHC Maneuver to Clear Structure position (SR, SP, EP within 2 deg).

	Locked					
SR	SY	SP	EP	WP	WY	WR
+37.0	+58.9	-60.0	-102.0	-50.0	+15.0	-10.2
X	Y	Z	Pitch	Yaw	Roll	
+228	+32	+904	+99.6	+28.5	-92.1	
FOR	Unloaded – Chest 12/PP/F/6, SY Held					
Disp	W4>ISSACS					

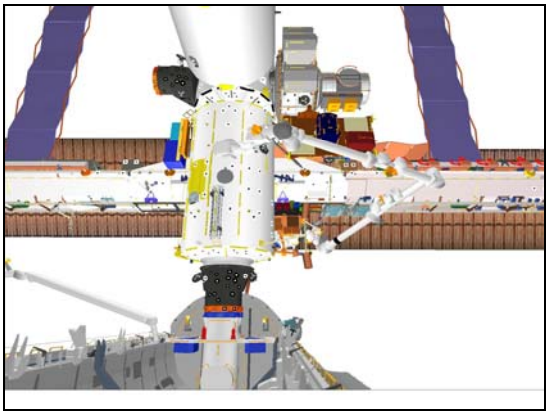


Figure 5.- Clear Structure
(92: Camera C: 0, 20).

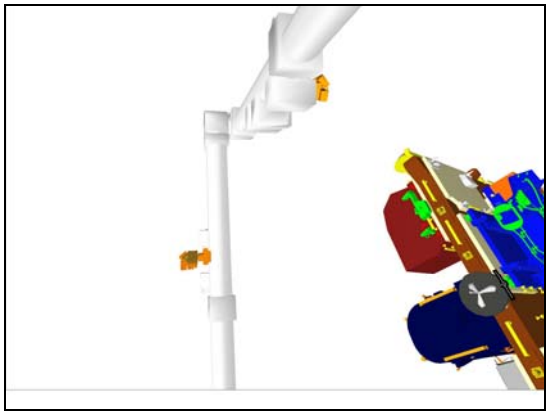


Figure 6.- Clear Structure
(13: LAB Stbd Zenith: 35, 18).

4. INHIBIT ORBITER NOSE JETS
   Verify with Shuttle Crew: forward jet manifold closed.

5. JOCAS TO INTERMEDIATE POSN

PCS MSS: SSRMS: SSRMS

Enter Mode – Joint OCAS (Verify blue)

SSRMS Joint OCAS

Input 'Joint Angles' 'Destination' for Intermediate position.

SR	SY	SP	EP	WP	WY	WR
+34.0	+30.0	-50.0	-50.0	+47.5	0.0	-138.6

NOTE
1. The Target and Error fields on the SSRMS Joint OCAS display will not be correct. This data should be verified and monitored on the Joint Angle Position overlay. (SCR 31169)

2. JOCAS will take approximately 5 minutes.

cmd Load (Verify Sequence Status – Confirm or Cancel)

MON Verify joint angles and errors are correct on Joint Angle Position overlay.

	SR	SY	SP	EP	WP	WY	WR
(current)	+37.0	+58.9	-60.0	-102.0	-50.0	+15.0	-10.2
TGT	**+34.0**	**+30.0**	**-50.0**	**-50.0**	**+47.5**	**0.0**	**-138.6**
ERR	+3.0	+28.9	-10.0	-52.0	-97.5	+15.0	+128.4

****
* If joint angles/errors are incorrect
PCS * **cmd** Cancel (Verify Sequence Status – Waiting Destination)
*
* Input correct Dest joint angles per table above.
*
* **cmd** Load (Verify Sequence Status – Confirm or Cancel)
*
MON * Verify joint angles and errors are correct on Joint Angle Position overlay.
****

PCS **cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

DCP AUTO SEQ → PROC

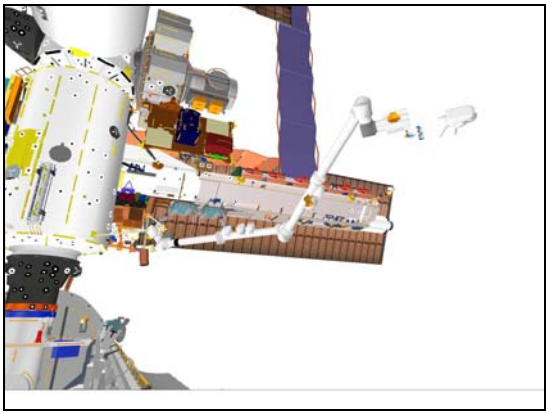


Figure 7.- Intermediate
(92: Camera C: 25, 20).

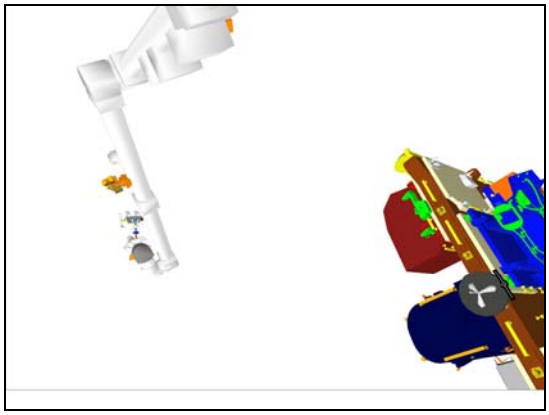


Figure 8.- Intermediate
(13: LAB Stbd Zenith: 35, 18).

PCS MSS: SSRMS: SSRMS

Verify Posn Hold – orange

Verify SSRMS at Intermediate position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+34.0	+30.0	-50.0	-50.0	+47.5	0.0	-138.6
X	Y	Z	Pitch	Yaw	Roll	
+268	+1219	+1540	+70.4	+47.8	+102.2	
FOR	Unloaded – Chest 12/PP/F/6, SY Held					
Disp	W4>ISSACS					

6. JOCAS TO ORBITER ACCESS

SSRMS Joint OCAS

Input ‘Joint Angles’ ‘Destination’ for Orbiter Access position.

SR	SY	SP	EP	WP	WY	WR
-25.0	+30.0	+30.1	+50.0	+47.5	0.0	-138.6

NOTE

1. Expect Singularity warning between EP -15.0 and +15.0

2. Minimum clearances at Orbiter Access Position are:
   APFR to Orbiter: 166 cm
   Tip Boom to Orbiter: 212 cm
   Base Boom to Orbiter: 375 cm

3. JOCAS will take approximately 9 min.

4. At the Orbiter Access position, and during gap-filler removal GCA maneuvers, the wrist cluster will be close to a self-collision configuration.

cmd Load (Verify Sequence Status – Confirm or Cancel)

MON Verify joint angles and errors are correct on Joint Angle Position overlay.

	SR	SY	SP	EP	WP	WY	WR
(current)	+34.0	+30.0	-50.0	-50.0	+47.5	0.0	-138.6
TGT	**-25.0**	**+30.0**	**+30.1**	**+50.0**	**+47.5**	**0.0**	**-138.6**
ERR	+59.0	0.0	-80.1	-100.0	0.0	0.0	0.0

****
* If joint angles/errors are incorrect
PCS * **cmd** Cancel (Verify Sequence Status – Waiting Destination)
*
* Input correct Dest joint angles per table above.
*
* **cmd** Load (Verify Sequence Status – Confirm or Cancel)
*
MON * Verify joint angles and errors are correct on Joint Angle Position
* overlay.
****

PCS **cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

DCP AUTO SEQ → PROC

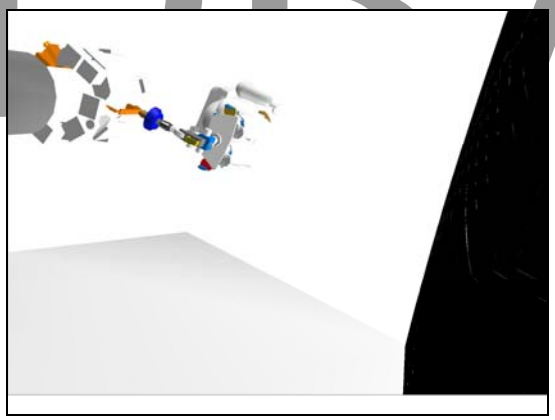


Figure 9.- Orbiter Access
(24: Tip Elbow: 30, -10).

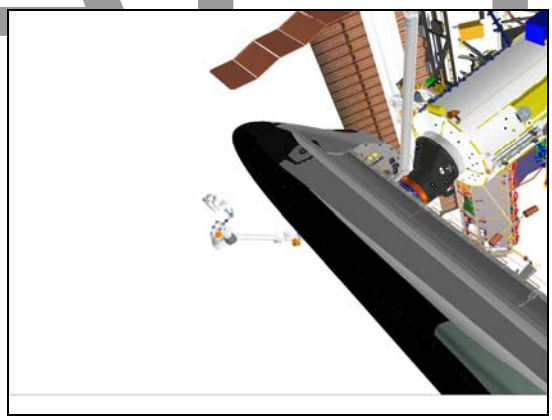


Figure 10.- Orbiter Access
(V10: OBSS ITVC: 105, -45).

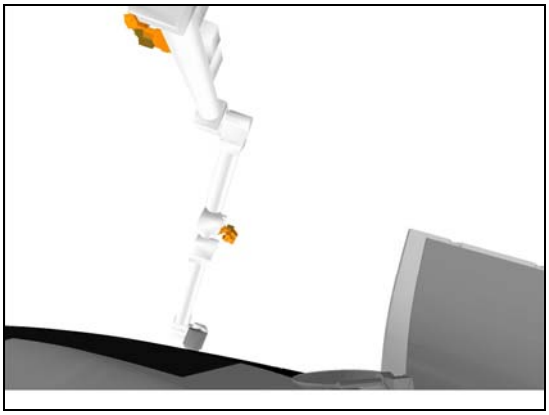


Figure 11.- Orbiter Access
(13: LAB Stbd Zenith: -100, 20).

PCS MSS: SSRMS: SSRMS

Verify Posn Hold – orange

Verify SSRMS at Orbiter Access position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
-25.0	+30.0	+30.1	+50.0	+47.5	0.0	-138.6
X	Y	Z	Pitch	Yaw	Roll	
+1511	-105	-53	+173.1	-1.5	-89.6	
FOR	Unloaded – Chest 12/PP/F/6, SY Held					
Disp	W4>ISSACS					

PCS MSS: SSRMS: Thrusters: Thruster Controls for MSS Ops

Verify 'Desat Request:' – Inh
Verify 'Auto Att Control Handover to RS' – Inh

7. GCA TO DAMAGE LOCATION 134-01 (PORT) ACCESS POSN
Configure cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
13: LAB Stbd Zenith (-100, 20) 22: Base Elbow (140, -10)	24: Tip Elbow (30, -10)	92: Camera C (20, 15)	OBSS ITVC (105, -45)

Change Command ▶ SSRMS ▶ Internal (Verify SSRMS>Internal)

PCS MSS: SSRMS: SSRMS

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock: Joint Lock

cmd Shoulder Yaw (Verify SY – Locked)

RHC/ THC — GCA per EVA call to Damage Location 134-01 Access position.

Expected Damage Location 134-01 Access position:

	Locked					
SR	SY	SP	EP	WP	WY	WR
-22.0	+30.0	+23.0	+70.0	+36.0	-2.0	-137.0
X	Y	Z	Pitch	Yaw	Roll	
+1381	-105	-54	+173.1	-1.6	-89.6	
FOR	Unloaded – Chest 12/PP/F/6, SY Held					
Disp	W4>ISSACS					

NOTE
To give the EV crewmember a more stable platform and to eliminate the possibility of a joint runaway near the bottom of the orbiter, brakes are required while at the worksite.

DCP — BRAKES SSRMS → ON (Verify ON)

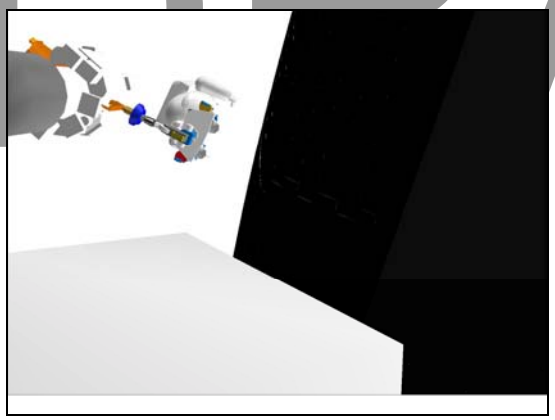


Figure 12.- Damage Location 134-01 (24: Tip Elbow: 30, -10).

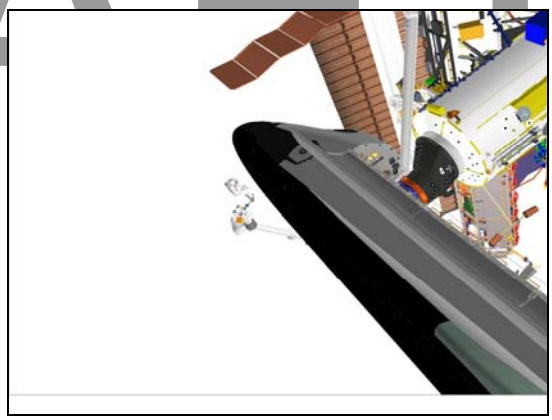


Figure 13.- Damage Location 134-01 (V10: OBSS ITVC: 105, -45).

8. GCA TO DAMAGE LOCATION 133-01 (STARBOARD) ACCESS POSN
On EVA GO,

DCP — BRAKES SSRMS → OFF (Verify OFF)

PCS — MSS: SSRMS: SSRMS

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock: Joint Lock

cmd Shoulder Yaw (Verify SY – Locked)

RHC/ THC GCA per EVA call to Damage Location 133-01 Access position.

Expected Damage Location 133-01 Access position:

	Locked					
SR	SY	SP	EP	WP	WY	WR
-36.3	+30.0	-2.1	+85.0	+39.9	+10.2	-150.3
X	Y	Z	Pitch	Yaw	Roll	
+1332	+162	+101	+179.1	-0.5	-91.4	
FOR	Unloaded – Chest 12/PP/F/6, SY Held					
Disp	W4>ISSACS					

NOTE
To give the EV crewmember a more stable platform and to eliminate the possibility of a joint runaway near the bottom of the orbiter, brakes are required while at the worksite.

DCP BRAKES SSRMS → ON (Verify ON)

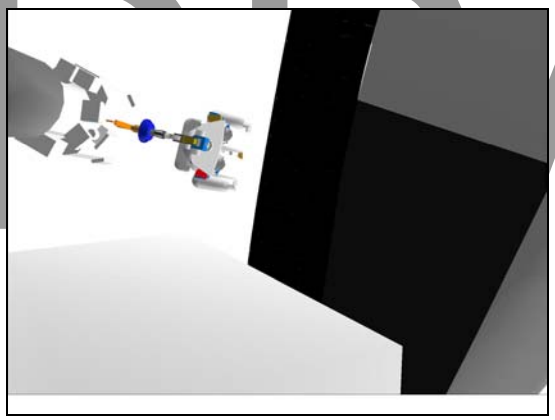


Figure 14.- Damage Location 133-01 (24: Tip Elbow: 30, -10).

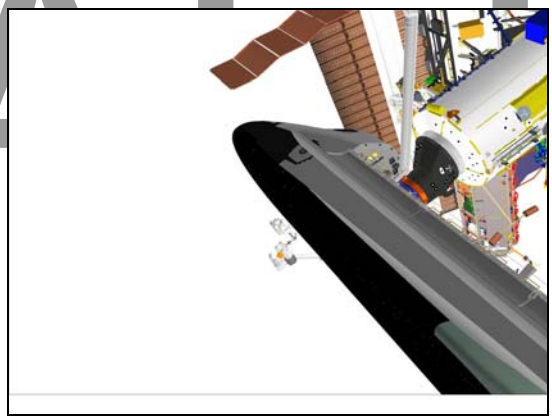


Figure 15.- Damage Location 133-01 (V10: OBSS ITVC: 105, -45).

9. MANEUVER BACK TO ORBITER ACCESS POSN
On EVA GO,

DCP BRAKES SSRMS → OFF (Verify OFF)

PCS MSS: SSRMS: SSRMS

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock: Joint Lock

cmd Shoulder Yaw (Verify SY – Locked)

RHC/ THC Maneuver back to Orbiter Access position (SR, SP, EP within 2 deg).

	Locked					
SR	SY	SP	EP	WP	WY	WR
-25.0	+30.0	+30.1	+50.0	+47.5	0.0	-138.6
X	Y	Z	Pitch	Yaw	Roll	
+1511	-105	-53	+173.1	-1.5	-89.6	
FOR	Unloaded – Chest 12/PP/F/6, SY Held					
Disp	W4>ISSACS					

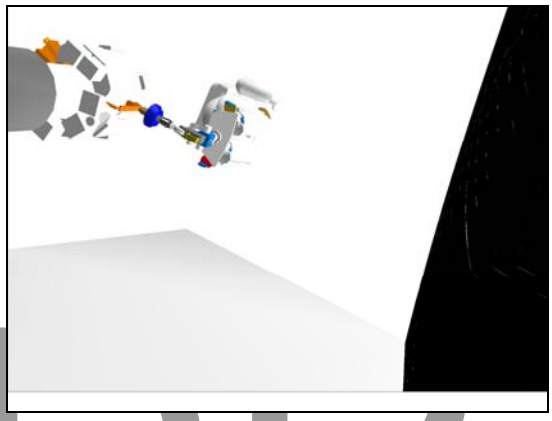


Figure 16.- Orbiter Access
(24: Tip Elbow: 30, -10).

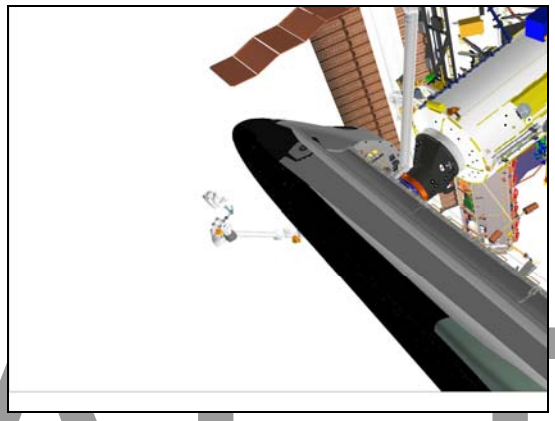


Figure 17.- Orbiter Access
(V10: OBSS ITVC: 105, -45).

10. JOCAS BACK TO INTERMEDIATE POSN

Configure cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
13: LAB Stbd Zenith (-100, 20)	24: Tip Elbow (25, -10) 22: Base Elbow (140, -10)	92: Camera C (20, 15)	OBSS ITVC (105, -45)

PCS MSS: SSRMS: SSRMS

Enter Mode – Joint OCAS (Verify blue)

SSRMS Joint OCAS

Input ‘Joint Angles’ ‘Destination’ for Intermediate position.

SR	SY	SP	EP	WP	WY	WR
+34.0	+30.0	-50.0	-50.0	+47.5	0.0	-138.6

NOTE

1. Expect Singularity warning for EP between +15 and -15 degrees.

2. JOCAS will take 9 min.

cmd Load (Verify Sequence Status – Confirm or Cancel)

MON Verify joint angles and errors are correct on Joint Angle Position overlay.

	SR	SY	SP	EP	WP	WY	WR
(current)	-25.0	+30.0	+30.1	+50.0	+47.5	0.0	-138.6
TGT	**+34.0**	**+30.0**	**-50.0**	**-50.0**	**+47.5**	**0.0**	**-138.6**
ERR	-59.0	0.0	+80.1	+100.0	0.0	0.0	0.0

****
* If joint angles/errors are incorrect
PCS * **cmd** Cancel (Verify Sequence Status – Waiting Destination)
*
* Input correct Dest joint angles per table above.
*
* **cmd** Load (Verify Sequence Status – Confirm or Cancel)
*
MON * Verify joint angles and errors are correct on Joint Angle Position overlay.
****

PCS **cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

DCP AUTO SEQ → PROC

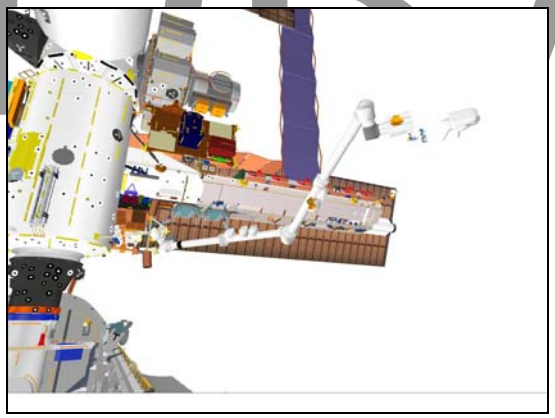


Figure 18.- Intermediate
(92: Camera C: 25, 20).

Figure 19.- Intermediate
(13: LAB Stbd Zenith: 35, 18).

PCS MSS: SSRMS: SSRMS

Verify Posn Hold – orange

Verify SSRMS at Intermediate position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+34.0	+30.0	-50.0	-50.0	+47.5	0.0	-138.6
X	Y	Z	Pitch	Yaw	Roll	
+268	+1219	+1540	+70.4	+47.8	+102.2	
FOR	Unloaded – Chest 12/PP/F/6, SY Held					
Disp	W4>ISSACS					

11. JOCAS 5 BACK TO CLEAR STRUCTURE POSN

SSRMS Joint OCAS

Input 'Joint Angles' 'Destination' for Clear Structure position.

SR	SY	SP	EP	WP	WY	WR
+37.0	+58.9	-60.0	-102.0	-50.0	+15.0	-10.2

NOTE
The Target and Error fields on the SSRMS Joint OCAS display will not be correct. This data should be verified and monitored on the Joint Angle Position overlay. (SCR 31169)

cmd Load (Verify Sequence Status – Confirm or Cancel)

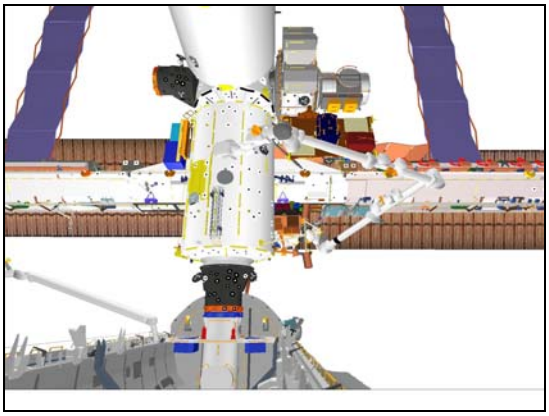
MON Verify joint angles and errors are correct on Joint Angle Position overlay.

	SR	SY	SP	EP	WP	WY	WR
Intermediate	+34.0	+30.0	-50.0	-50.0	+47.5	0.0	-138.6
TGT	**+37.0**	**+58.9**	**-60.0**	**-102.0**	**-50.0**	**+15.0**	**-10.2**
ERR	-3.0	-28.9	+10.0	+52.0	+97.5	-15.0	-128.4

****
* If joint angles/errors are incorrect
PCS * **cmd** Cancel (Verify Sequence Status – Waiting Destination)
*
* Input correct Dest joint angles per table above.
*
* **cmd** Load (Verify Sequence Status – Confirm or Cancel)
*
MON * Verify joint angles and errors are correct on Joint Angle Position
* overlay.
****

PCS **cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

DCP AUTO SEQ → PROC



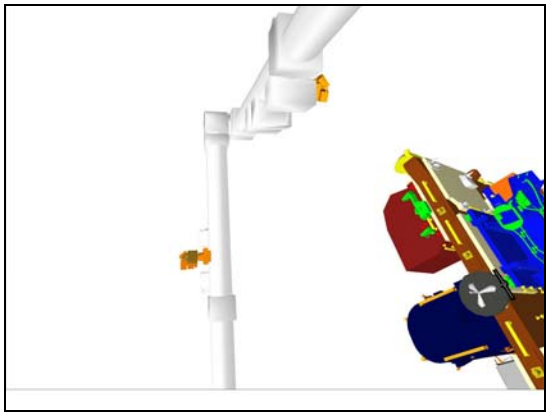


Figure 20.- Clear Structure
(92: Camera C: 0, 20).

Figure 21.- Clear Structure
(13: LAB Stbd Zenith: 35, 18).

PCS MSS: SSRMS: SSRMS

Verify Posn Hold – orange

Verify SSRMS at Clear Structure position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+37.0	+58.9	-60.0	-102.0	-50.0	+15.0	-10.2
X	Y	Z	Pitch	Yaw	Roll	
+228	+32	+904	+99.6	+28.5	-92.1	
FOR	Unloaded – Chest 12/PP/F/6, SY Held					
Disp	W4>ISSACS					

12. ORBITER NOSE JETS
Give Shuttle crew GO to override forward jet manifold statuses to open.

NOTE
Steps in gray are performed by shuttle crew.

O15:F RJDA 1B L1/L5/R1 MANF LOGIC – ON
O16:F RJDA 2B L3/R3/R5 MANF LOGIC – ON
RJDF 2B F4/F5 MANF LOGIC – ON
RJD MANF L5/F5/R5 DRIVER – ON

GNC 23 RCS
RCS FWD – ITEM 1 EXEC (*)
MANF VLVS OVRD 1 – ITEM 40 EXEC (OP)
MANF VLVS OVRD 2 – ITEM 41 EXEC (OP)
MANF VLVS OVRD 3 – ITEM 42 EXEC (OP)
MANF VLVS OVRD 4 – ITEM 43 EXEC (OP)
MANF VLVS OVRD 5 – ITEM 44 EXEC (OP)

O15:F RJDA 1B L1/L5/R1 MANF LOGIC – OFF
O16:F RJDA 2B L3/R3/R5 MANF LOGIC – OFF
RJDF 2B F4/F5 MANF LOGIC – OFF

A6U DAP: as reqd

13. APFR EGRESS/REMOVAL
Configure cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
13: LAB Stbd Zenith (50, -6)	24: Tip Elbow (-20, 0) 22: Base Elbow (-90, -15)	92: Camera C (0, 20)	OBSS ITVC (70, -45)

PCS MSS: SSRMS: SSRMS

Enter Mode – Standby (Verify blue)

Change Command ▶ W4 ▶ ISSACS (Verify W4>ISSACS)

PCS MSS: SSRMS: SSRMS

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock: Joint Lock

cmd Shoulder Yaw (Verify SY – Locked)

RHC/ THC GCA per EVA call for APFR Egress and Removal.

14. MANEUVER TO JOCAS SETUP POSITION

On EVA GO,
Verify APFR and Tethers removed from arm and EV Crew is clear of the area.

PCS MSS: SSRMS: SSRMS

Enter Mode – Standby (Verify blue)

Change Unloaded Parameters ▶ Unloaded ▶ LEE Tip SYH
Verify 'Unloaded Parameters' (two) – LEE Tip, SY Held

PCS MSS: SSRMS: SSRMS

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock: Joint Lock

cmd Shoulder Yaw (Verify SY – Locked)

THC/ RHC Maneuver to JOCAS Setup position (SR, SP, EP within 2 deg).

	Locked					
SR	SY	SP	EP	WP	WY	WR
+29.8	+58.9	-71.1	-111.3	-34.1	+18.1	-9.4
X	Y	Z	Pitch	Yaw	Roll	
+248	+36	+921	+97.8	-61.6	-70.4	
FOR	Unloaded – LEE Tip, SY Held					
Disp	W4>ISSACS					

15. JOCAS TO LAB PDGF PRE-GRAPPLE

PCS MSS: SSRMS: SSRMS

Enter Mode – Joint OCAS (Verify blue)

SSRMS Joint OCAS

Input 'Joint Angles' 'Destination' for LAB PDGF Pre-Grapple position.

SR	SY	SP	EP	WP	WY	WR
+34.0	+58.9	-104.3	-82.6	-132.3	+16.8	-72.8

NOTE
The Target and Error fields on the SSRMS Joint OCAS display will not be correct. This data should be verified and monitored on the Joint Angle Position overlay. (SCR 31169)

cmd Load (Verify Sequence Status – Confirm or Cancel)

MON Verify joint angles and errors are correct on Joint Angle Position overlay.

	SR	SY	SP	EP	WP	WY	WR
(current)	+29.8	+58.9	-71.1	-111.3	-34.1	+18.1	-9.4
TGT	**+34.0**	**+58.9**	**-104.3**	**-82.6**	**-132.3**	**+16.8**	**-72.8**
ERR	-4.2	0	+33.2	-28.7	+98.2	+1.3	+63.4

****
* If joint angles/errors are incorrect
PCS * **cmd** Cancel (Verify Sequence Status – Waiting Destination)
*
* Input correct Dest joint angles per table above.
*
* **cmd** Load (Verify Sequence Status – Confirm or Cancel)
*
MON * Verify joint angles and errors are correct on Joint Angle Position overlay.
****

PCS **cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

DCP AUTO SEQ → PROC

PCS MSS: SSRMS: SSRMS

Verify Posn Hold – orange

Verify SSRMS at LAB PDGF Pre-Grapple position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+34.0	+58.9	-104.3	-82.6	-132.3	+16.8	-72.8
X	Y	Z	Pitch	Yaw	Roll	
+352	-236	+791	+90.0	+37.6	+180.0	
FOR	Unloaded – LEE Tip, SY Held					
Disp	W4>ISSACS					

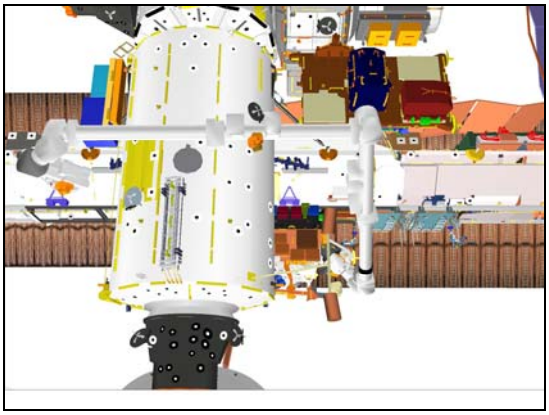


Figure 22.- LAB PDGF Pre-Grapple (92: Camera C: 0, 20).

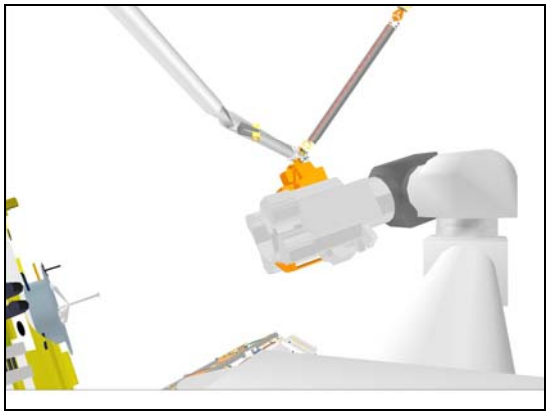


Figure 23.- LAB PDGF Pre-Grapple (24: Tip Elbow: -20, 0).

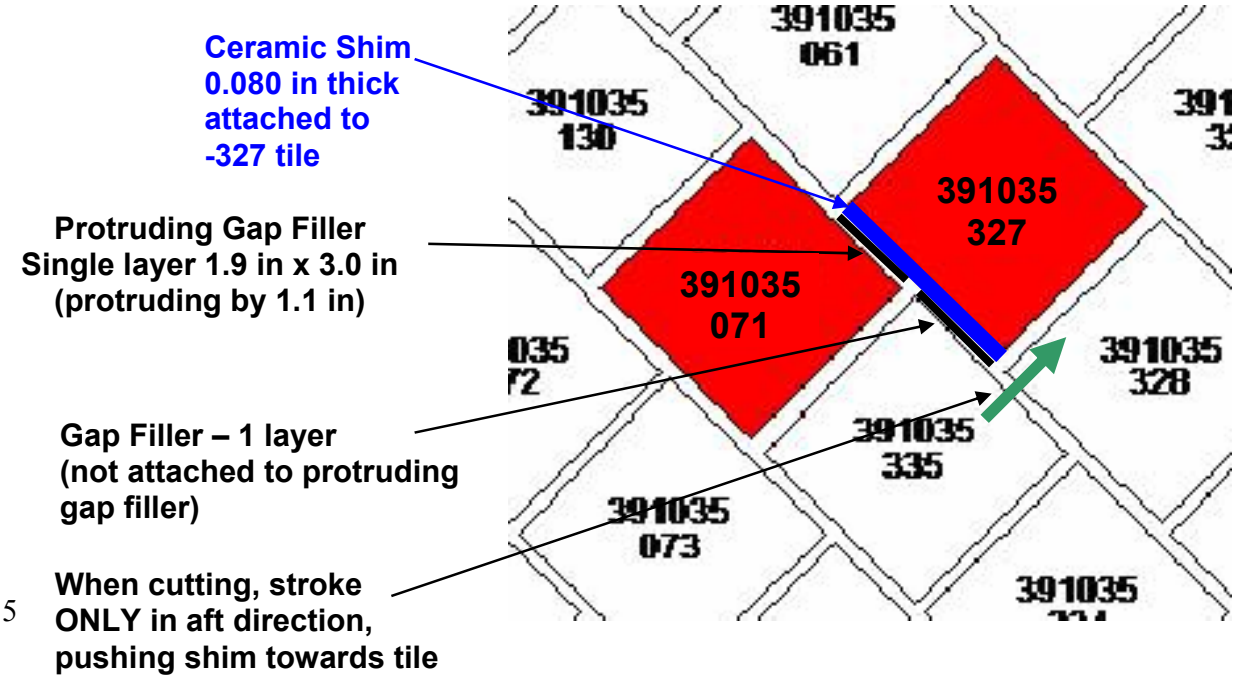
16. SETUP FOR LAB PDGF GRAPPLE PROCEDURE

PCS	MSS: SSRMS: SSRMS
	Change Command ▶ SSRMS ▶ Internal (Verify SSRMS>Internal)
	Change Display ▶ W4 ▶ LAB PDGF (Verify W4>LAB PDGF)
DCP	BRAKES SSRMS → ON (Verify ON)

is colder, it shrinks, pulling the tiles and gaps closer together. Discovery's skin temperature is around 24F which is believed to be fairly benign, so it is believed that the gap fillers can be pulled out easily.

II. Port (Triangular) Gap Filler Site Details

This site is 4 tiles aft of the port edge of the NLGD. The protruding gap filler is a single layer, ~1.9 in x 3.0 in and has the port corner protruding ~1.1 in above the tile. There is a ceramic shim (tile extension) bonded to the tile that's on the aft side of the protruding gap filler. Originally we thought the shim was protruding, but after closer inspection we are confident it is the gap filler only and the shim is still attach to the tile on it's aft side (tile number -327).



MSG 095 (11-0702) - SRMS AND SSRMS MANUEVER PLAN FOR EVA 3

The big picture plan for the robot arm manuevers during EVA 3 is as follows:

1. The SSRMS will be manuevered to grapple MBS PDGF1 following the ESP 2 installation task
2. While the SSRMS is grappling MBS PDGF1, the SRMS will be positioned via SINGLE joint to perform the Tile Board DTO Survey.
3. The SSRMS will walk off of the Lab PDGF while the SRMS is finishing the Tile Board DTO Survey and wait at the Lab PDGF pre-grapple position for the SRMS to be manuevered via SINGLE to the Gap Filler Viewing position.
4. The SRMS will remain at the Gap Filler Viewing position until the completion of the EVA when the WR joint will be driven to place the SRMS back at the CMG R&R Viewing position.